

INDIGESTION

GEORGE HERSCHELL



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INDIGESTION.

AN INTRODUCTION TO THE STUDY OF
THE DISEASES OF THE STOMACH.

BY

GEORGE HERSCHELL, M.D. LOND.

SECOND EDITION.



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PREFACE TO THE SECOND EDITION.

I HAVE to thank the profession for the favourable reception which has been accorded to this work notwithstanding its many imperfections.

The present edition has been considerably enlarged, and to a great extent rearranged, with the result, I venture to hope, of enhancing its utility.

In its present form it does not profess to be a complete treatise upon all the disorders of the digestive apparatus, nor to exhaust the subject of diseases of the stomach. Its aim is simply to present to the student, in as concise a form as may be, the minimum amount of knowledge of modern methods, with which he can hope to study at all scientifically the chronic disorders of digestion which may come under his observation.

By avoiding as much as possible controversial points, and confining myself to facts now generally admitted as matters of common knowledge, I have been enabled to eliminate references from the text.

By grouping these, in the form of a classified biblio-

graphy at the end of a book, I believe that I shall better assist those who wish to further study the subject.

In addition, I have included in the present volume a series of illustrative cases, for commentary, and practice in diagnosis.

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25, QUEEN ANNE STREET,
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January, 1895.

INDIGESTION.

CHAPTER I.

THE PROCESS OF NORMAL DIGESTION.

Food-stuffs—Digestion in the Mouth—In the Stomach—In the Duodenum—The Intestinal Juice—Digestion in the Large Intestine—Fæces.

Food has the twofold office of replacing tissue and of supplying energy. Some articles perform the first function, some the second, and some both.

To fully comprehend the process of digestion, and the departures from its normal performance, we must study these different substances separately, and note the changes which take place in each as they are prepared for absorption by coming in contact with the several digestive fluids.

The following short description, whilst not professing to treat the subject exhaustively, will, it is hoped, serve to remind the reader of the more important facts.

Food may be conveniently divided into six classes :

1. PROTEIDS.—These, again, may be subdivided into :

(a) *Albuminoids proper*, which may be either animal or vegetable. These are egg-albumin, blood-fibrin, muscle-albumin or fibrin, myosin, globulin, animal and vegetable casein, and legumin. To this list must be added keratin and elastin.

1. PROTEIDS.—(a) *Albuminoids proper* (continued):

Although ultimately chemically identical, egg-albumin and the albumin of muscle must be distinguished, as they present physiological differences. If egg-albumin be introduced into the circulation, it is very soon eliminated by the kidneys unchanged; but if serum-albumin (as found in muscles) be similarly injected, it does not reappear in the urine as such, but is absorbed into the system. The proteids of muscle are chiefly the globulins—myosin, myoglobulin, and a body termed myo-albumin which is more soluble than the others and nearly resembles serum-albumin.

Keratin, the chief constituent of the skin, nails, hair, and feathers, was until recently classed among the gelatin-yielding substances. We now know that it must be distinguished from them, first, by reason of the larger quantity of sulphur it contains; and secondly, that tyrosin is one of the products of its decomposition. For the last reason, elastin, formerly placed in the same category, must now be removed.

(b) *Gelatin and Gelatin-producing Substances*, such as connective-tissue, chondrin, and bone.

(c) *Extractives*, as kreatin, kreatinin, etc.

2. FATS.

3. CARBO-HYDRATES—Starches, sugars, and their derivatives, such as the organic acids and cellulose.

4. SALTS.

5. WATER.

6. ACCESSORY FOODS, such as tea, coffee, cocoa, and alcohol.

All ordinary diets contain the first five groups variously distributed among common articles of food.

For example, in *meat*, we shall find albumin, muscle-fibrin, fat, connective-tissue and myosin, and in addition in meat that has been cooked we shall find gelatin, and the extractives that give the flavour or aroma.

It may be remarked here that the myosin, of which the bulk of the lean of meat is composed, does not exist as such during life. In the living muscle it is represented by a semi-fluid substance, which coagulates at its death into the clot which we know chemically as myosin.

Fat consists of a slight framework of connective-tissue fibres enclosing in their meshes large fat-cells. Supported by this framework are bloodvessels and lymphatics. The vesicles thus formed are filled with drops of fat which push on one side the protoplasm and nucleus of the cell.

In *bread* we shall find starch, gluten, sugar, and salts.

In *vegetables* we have either starch and cellulose alone, as in the potato, where they are associated with salts of very great value, or we may find in addition vegetable albumin, as in beans and other legumens. I think that we may say roughly that an average vegetable consists of a little fat, some important salts, large quantities of starch, and a great deal of water, all confined in cellulose cell-walls.

These, then, being the various food-stuffs on which we have to live, let us study the changes that they undergo in their passage through the alimentary canal.

Of the proximate principles enumerated above, two—viz., salts and water—can pass by simple diffusion through mucous membrance, and thus enter the animal body without undergoing any change. Food belonging to the other groups—proteids, carbo-hydrates, and fats—must first undergo a preparatory process by which it is altered in its properties, and rendered capable of absorption. This

necessary change is spoken of as *digestion*, and is effected at the surfaces of the digestive tract, through the agency of the various secretions with which the alimentary substances come successively in contact. These secretions are the saliva, gastric juice, bile, pancreatic juice, and intestinal juices, and are severally elaborated by the glands within the walls of the digestive tract, or are furnished by glands whose ducts open into it.

The first change that the food undergoes takes place in

The Mouth.

Here the food is broken up by the act of mastication, and intimately mingled with the saliva.

The saliva is the mixed secretion of the salivary and mucous glands of the mouth, and is a viscid, ropy, opalescent fluid with an alkaline reaction. The quantity secreted in the twenty-four hours has been estimated at from 1,000 to 2,000 grammes, or about a litre and a half. The specific gravity varies from 1002 to 1009, but is usually about 1004. It is composed of water, mucin, serum-albumin, serum-globulin, and salts, contains a ferment, ptyalin, and carbon dioxide gas in solution. The total solids amount to 0.5 per cent, and consist of epithelium, much mucin, ptyalin, albumin, and salts. These salts are chiefly the carbonate and phosphate of lime, carbonate and chloride of sodium. In many cases a small quantity of sulphocyanide of potassium may be detected in normal mixed saliva, either by the claret colour that it strikes with perchloride of iron, or by the fact that it is able to liberate free iodine from iodic acid, thus turning starch-paper blue which has been moistened with this reagent.

Saliva also contains what are known as salivary corpuscles, and almost always bacteria, of which by far the commonest form is the *Leptothrix buccalis*. It is now

certain that the salivary corpuscles are secreted by the so-called gingival organ, a collection of modified epithelium cells beneath the free edges of the gums.

Saliva performs three functions, all of great importance :

1. The parotid saliva, which enters the mouth opposite the second molar tooth, is of a watery character, containing principally serum-albumin and serum-globulin. It moistens the food, and aids attrition by the teeth. It keeps the mouth clean from particles of food, which if allowed to decompose would very soon injure the teeth.

2. The submaxillary and sublingual saliva, containing more mucin, and consequently more viscid in character, is poured out on to the *frænum linguæ*, and facilitates the formation of a bolus from the masticated food.

3. The third, and without doubt the most important, action of the saliva is that of changing starch into maltose and grape-sugar.

This action is due to the strong and energetic ferment, called *ptyalin*, or, better still, *salivary diastase*, which is able to act upon all starchy substances, not even excepting *glycogen*.

By the action of *ptyalin*, starch is changed into maltose and a little grape-sugar. This change goes on very much quicker if the starch has been sufficiently cooked to rupture the envelopes of cellulose which enclose the starch granules, and in such case is very little slower than the action of pancreatic juice in the same direction. The rapidity of the action, indeed, is such that after a very few seconds the mixture will begin to have the property of producing the characteristic reaction with iodine. However, before the end-product maltose is reached, various intermediate substances are formed from the starch, called respectively *amylodextrin*, *erythro-dextrin*, and *achroodextrin*. Each of these has a characteristic reaction of its own. Thus, whilst soluble starch gives a blue colour with iodine solution, *erythro-dextrin*

gives a red-brown coloration, and achroodextrin no colour at all.

The first effect of the salivary or pancreatic ferment upon starch-paste is to liquefy it. This change takes place very rapidly, a very few minutes sufficing to render the stiff paste diffuent. If you test as soon as liquefaction has taken place, you will get a pure blue with a weak iodine solution, and a very slight reaction of sugar with Fehling's solution. It is theoretically possible to seize the exact moment when liquefaction has taken place, but conversion into sugar has not yet begun, and to obtain a pure starch reaction, Fehling's solution at the same time denoting the absence of sugar, but in actual practice it cannot be done. In a few more minutes you will get, by adding more iodine to the diluted blue solution, a deep-violet colour, showing the presence of erythrodextrin mixed with starch. After a few more minutes you will be unable to get the blue reaction with iodine with a fresh portion of the starch-paste, showing that the starch has been completely converted, but the reddish erythrodextrin reaction will be very marked. At a little later stage you will obtain a yellowish-brown colour. After a further interval you will cease to obtain any reaction with iodine, showing that all the starch has been converted into achroodextrin. All this time the sugar reaction goes on increasing in intensity, and continues to do so for some time after the iodine reaction has stopped.

It is extremely probable that one of the chief uses of the salivary ferment is to liquefy the starch-jelly into which we have converted our farinaceous food by cooking processes. It is evident on reflection that this must be of the greatest importance, and that even if the saliva had no other function than this, it would have played a very considerable rôle in the digestion of our food. We can, indeed, imagine no substance much more difficult

for the gastric juice to permeate than the thick pasty condition in which starch exists in our modern gruels, pie-crusts, and farinaceous puddings. It is a fact to be remembered, that in the herbivora the saliva contains very little ptyalin, and that in some animals, such as the horse, it is absolutely devoid of diastatic power. The explanation of this interesting circumstance may be found in the proverbial economy of Nature, who does not provide functions which can never be exercised. As ptyalin can only act with advantage upon *cooked* starch, and as a rule animals are fed on *raw* grain, diastatic action would be useless in their case. Reasoning from analogy, it is far from improbable that in the earlier races of men, who lived before the discovery of fire, diastatic power was absent, and that it only became developed as opportunity was afforded for its use.

From the rapidity with which the diastatic ferment acts, one would on first thoughts naturally suppose that all the starch would be quickly converted into sugar. But this is evidently not the case, as on examining the stomach contents of healthy people several hours after a meal, you will still get the violet iodine reaction of erythrodextrin mixed with unaltered starch. This arrest of the diastatic action of the salivary ferment is partly due to the presence of free hydrochloric acid in the stomach, and partly due to the condition in which the starch of food exists. In bread and pastry the starch is not in the form of mucilage, as in our experiments, but exists as solid paste, often imperfectly cooked. It is obvious, therefore, that if it be in excess, or improperly masticated, a great deal must reach the duodenum unchanged, and that the greater part of the work of converting it into sugar will fall upon the pancreatic juice. It has been experimentally shown that free acids in small quantities will check, and in large quantities absolutely stop, the diastatic action of the saliva. And since under normal

conditions the percentage of HCl in the stomach during digestion is at least 0·2, the cause of the cessation of the amylolytic action is very clear.

It was formerly supposed that under the most favourable circumstances the actual change in the mouth was very slight, and that it was immediately arrested when the food came in contact with the acid gastric juice in the stomach. This view has been very generally abandoned, as it has been ascertained that the sugar-forming function of the salivary ferment continues for from ten minutes to an hour after the food has reached the stomach.

The practical result of this is that, within an hour after a test breakfast containing a small amount of starchy matter, so much starch should have been changed into achroodextrin, maltose, or dextrine that the addition of small quantities of the iodine solution to some of the filtered stomach contents should give no coloration. This point will be again referred to when we come to the consideration of the tests which are used for examining materials extracted from the stomach.

In the stomach the smaller portion of the starch only is converted into dextrose, the greater bulk becoming maltose, which, passing into the duodenum, is there transformed into dextrose.

It is probable that the action of the pancreatic juice is materially facilitated by the fact that the starch has been in contact with the saliva. One may easily imagine that it will be far easier for the alkaline pancreatic juice to revive and continue an action which has been once started in the mouth than to originate the same *de novo* in starch which has been thoroughly acidified by contact with the gastric juice. Experiments have demonstrated that after the diastatic action of the ptyalin has been completely arrested by contact with a 0·15 per cent. solution of HCl for one hour, it may be successfully revived by alkalizing with sodium carbonate.

In the mouth the saliva will feebly emulsify a little of the fat contained in the food, and will probably dissolve certain soluble ingredients of the food, such as salts and sugar. On the remaining constituents of the food it has no action.

The next step is that the food, broken up, mixed with saliva, and with the transformation of the starch into maltose and dextrin well begun, passes into

The Stomach.

The stomach may be described as a large hollow compound gland, the walls of which contain, besides the glandular elements, layers of muscular fibres. Its cavity is lined with mucous membrane, and into it is continually being poured a highly complex secretion which we call gastric juice. The purpose of this secretion, as we shall presently see, is to convert the proteid portion of our food, already more or less coagulated by the cooking processes to which it has been subjected, into soluble albumoses and peptones. The mechanism of secretion is so adjusted that the stimulus of the food itself in the stomach will cause a flow to take place.

During the period of digestion in the stomach the food is subjected to continual churning movements, by which it is intimately mixed with the gastric juice, and as it becomes digested is gradually expelled through the pylorus into the duodenum.

In a pure state, the gastric juice is a clear, colourless acid fluid of a specific gravity, varying from 1002 to 1003, and contains about .5 per cent. of solids. The quantity secreted in the twenty-four hours has been variously estimated, but is probably about 1,580 grammes. This is nearly one-tenth of the body-weight, and will measure about 7 litres. This quantity, however, is not all discharged from the body, but a large proportion of it is reabsorbed in the small intestine. This will explain

the well-known fact that in cases where large quantities of the gastric secretion are removed from the system, as in obstinate vomiting, there is a great diminution of the amount of chlorides to be found in the urine. The normal acid of the gastric juice is now admitted to be hydrochloric, and it is this, in conjunction with the ferments present, which produces the characteristic action upon the food. The acidity of the gastric juice varies from .1 to .22 per cent. in the human being, but in dogs may reach .3 or more. It is highest at the middle period of gastric digestion, and less at the beginning and end of the process. The hydrochloric acid of the gastric juice is of use in five different ways :

1. It has an antiseptic action, stopping abnormal fermentation. It also serves to destroy organisms which have obtained access to the stomach. This antibacillary action goes on not only in the stomach, but also in the duodenum, and perhaps in the large intestine. It, however, only affects micro-organisms normally found in the stomach, and has very little influence upon pathogenic bacteria. The experiments, it must be remembered, which apparently demonstrated the fact that the bacilli of tubercle, charbon, typhoid, and cholera, were destroyed by the gastric juice, were conducted at a temperature of 100° Fahr. with pure, undiluted gastric juice.

2. It has, as we shall presently see, the power of forming active ferments out of the inactive proenzymes.

3. It regulates reflexly the peristaltic action of the walls of the stomach, and appears to act vicariously when there is a deficiency of motor impulses sent from the regulating centre.

4. It converts albumin into syntonin or acid albumin.

5. It has the power of converting cane-sugar into invert sugar.

The peptic ferments of the gastric juice exist in the first instance as inactive bodies called proenzymes

(pepsinogen), which are converted into active ferments by the agency of the HCl.

They are two in number : pepsin and the milk-curdling ferment.

Pepsin, the first of these, has the property of changing, by the help of the HCl, egg-albumin or fibrin into peptone, and of taking from gelatin its power to gelatinize, changing it into what is technically termed glue peptone.

No other mineral or organic acid has the same power of converting pepsinogen into pepsin.

It is probable that the secretion of the glands of the fundus of the stomach is only an inactive proenzyme which requires the action of HCl to convert it into the active pepsin before it can be utilized in the digestion of food. This pepsinogen differs from pepsin, inasmuch as that whilst the latter is destroyed in a few minutes by sodium carbonate, the former is only slowly attacked, and, on the other hand, that pepsin is quickly destroyed by the action of carbonic acid, whilst pepsinogen is only very slowly acted upon.

The action of pepsin and hydrochloric acid together upon the food is as follows :

Albuminoids are changed first into syntonin or acid albumin, then into albumoses, and finally into peptone, and some of the peptone is changed subsequently into serum albumin.

In the normal stomach from earliest childhood there also exists another ferment, which possesses the power of precipitating casein from milk, and will act upon it in neutral solution. It is called the milk-curdling or rennet ferment. Of course, as is well known, HCl will itself throw down the casein in milk, but this ferment is quite distinct from it, and acts independently of it. It is secreted by special rennet glands in the stomach, and it is this substance which coagulates casein in the making of cheese. The neutral infusion of the rennet glands has

also the power either in neutral or alkaline solutions of changing milk-sugar into lactic acid. The secretion of the rennet ferment commences at the same time as that of HCl , increases when the latter increases, and diminishes when it diminishes.

As regards the part played by the milk-curdling ferment in gastric digestion, we know nothing for certain. It is extremely improbable that it is the agent which actually curdles milk in the human stomach, as the acid of the gastric juice, which has the same action, would have been beforehand with it.

In addition to the peptone formation and the precipitation of casein, other actions go on to a slight extent in the stomach.

Cane-sugar is changed into grape-sugar (invert sugar) by the action of the HCl , and a small proportion of the fats are split up into glycerin and fatty acids. Starch and gums are not acted on.

These are really all the changes in the food which take place during its sojourn in the stomach.

The precise action upon a meal of meat and bread may be described somewhat in the following manner :

The gelatin-yielding parts of the meat, viz., the connective-tissue, the white fibrous tissue, the cartilage, the matrix of bone and gristle, the structureless membranes, such as the sheathes of nerves, muscles of glands, are dissolved and peptonized. The fat globules are set free, and the muscle fibres split up into discs by the removal of the material which covers them.

The change continuing, these albuminoid materials become converted into albumose, and finally into peptone. The gluten of the bread and the protoplasmic contents of vegetable cells are also changed into similar substances, while their envelopes of cellulose remain unchanged.

It is probable that while in the stomach a certain proportion of the watery solution of salts and grape-sugar

are absorbed directly into the veins of the stomach, likewise alcohol, and the serum-albumin that it is supposed a certain proportion of the albuminoids are changed into.

Our knowledge of the power of the stomach in this direction is limited to the fact that water, salt, sugar, albumoses, and peptone are absorbed by the stomach. How much is absorbed we do not know. There have been also many controversies as to the precise method. Some suppose that crystalloids, such as salt and sugar, are absorbed by diffusion; but since we know that other substances, such as albumin, mucin, gelatin, and gums, which, being colloids, do not diffuse, are yet certainly absorbed, we are driven to the conclusion that active cellular action most probably has a great deal to do with the process.

In the digestion of meat the exact process appears to be that the hydrochloric acid converts the outer layer into acid albumin; this is dissolved off by the pepsin in the form of albumose, leaving a fresh surface ready to be again acted upon by hydrochloric acid.

There are three stages in digestion in the stomach.

The first continues for about fifty minutes after a meal of lean meat, and in this lactic acid alone is present. This lactic acid is believed to be simply set free from the proteid and carbo-hydrate elements of the food, and not secreted by the stomach. If some of the contents of the stomach are examined, digestion is not found to have proceeded very far as yet, as the transverse striæ of the muscular fibres can be plainly seen. After a meal of bread and potatoes this stage lasts only about thirty minutes. Pure starch or pure albumin, when introduced into a stomach that had been washed out, has been found to produce a secretion of hydrochloric acid alone.

In the second stage, which continues up to sixty or ninety minutes after the food has been swallowed, we find that hydrochloric acid is present as well as the lactic.

Digestion has now commenced in earnest, and the remains of the meat have a paler tint.

In the third stage, which is at its height two hours after the meal, hydrochloric acid alone is found in the stomach. In the case of carbo-hydrates, the lactic acid is apparently formed by fermentation.

(The subject of lactic acid fermentation will be found in greater detail on page 16.)

Whilst these processes are going on, the contents of the stomach are being subjected to a series of movements, which have for their object to further break up the masses of food, and to eject through the pylorus so much of it as has undergone solution. The movements of the stomach are of two kinds :

(1) *Rotatory* or *churning* movements, which occur periodically, and persist for several minutes at a time ; and (2) a *peristalsis*, which occurs also periodically, and which forces the food as fast as it is dissolved through the pylorus into the duodenum. These latter movements commence about a quarter of an hour after the meal has been taken, and continue for about five hours. These movements are most active at the pyloric end of the stomach, and mechanically open the pylorus by the contraction of the longitudinal muscular fibres of the stomach.

There are two theories as to the agency by which the muscular movements of the stomach-walls are induced ; the first being that they are caused by the local irritation of the HCl. There is something to be said in favour of this theory, from the well-known fact that when the HCl is deficient the muscular movements are generally below the normal. The second is that the peristaltic movements are set up by the local congestion which accompanies the digestive act, which irritates local ganglia acting automatically on the application of such stimuli.

As regards the mechanism of the secretion of gastric

juice in the stomach, it has been demonstrated that the presence of the saliva in the stomach has a distinct effect in promoting the flow of gastric juice. And this is only what we should expect, as we know that an alkali in the empty stomach always causes a flow of the acid gastric juice. In a case where there was marked diminution of gastric juice, the experiment was made of introducing the whites of three eggs into the stomach, and withdrawing them after two hours. This was done twice; the first time saliva was forbidden to be swallowed, and in the second it was allowed to be swallowed freely. In the first case the albumin was very slightly digested, and the gastric juice showed very little peptonizing power; in the second case it was perfectly digested.

In addition to the changes in the food which we have described, certain fermentative processes take place in the stomach during normal digestion unaccompanied by symptoms of any kind. These fermentations are the work of schizomycetes, and it is not difficult to account for their presence in the stomach. It has been proved conclusively by Miller, first, that these organisms exist in great abundance in the mouth; secondly, that they require a proportion of .2 per cent. of free hydrochloric acid for their destruction. Now, we know very well that that degree of acidity is only reached in the stomach at the height of digestion, which would not be until three or four hours after a full meal. We also know that this degree of acidity will gradually diminish again until the food leaves the stomach. There is thus obviously an opportunity for fermentation to take place both at the beginning and end of the digestive process.

The most important of these is the lactic acid fermentation. The bacillus which causes this fermentation is a short plump rod of from 1 to 1.7 μ long and 0.3 or 0.4 μ in thickness. It is fixed and spore-bearing. It grows best between the temperatures of 35° and 42° C., but

is able to live in a temperature as low as 10° C., or as high as 42.5° C.

Pasteur pointed out as early as 1857 that the formation of lactic acid from milk-sugar depended upon the presence of a micro-organism, but Hüppe was the first to cultivate a definite bacillus. It splits up milk-sugar into four molecules of lactic acid, after a preliminary change into two molecules of glucose. It also has the power of producing lactic acid from cane-sugar, with the simultaneous evolution of carbonic acid gas.

There are several other bacteria which have the power of forming lactic acid in solutions of carbo-hydrates.

The fact that the lactic acid formation is arrested when the stomach contents contain a certain proportion of hydrochloric acid will give us an explanation of the three stages into which we know that the digestion in the stomach is divided—the first stage, in which lactic acid alone is found; the second stage, in which we find both lactic and hydrochloric acids; and the third, in which hydrochloric acid alone is found.

As regards the *rôle* which lactic acid plays in the digestive process we know nothing for certain. It has been suggested that it may be instrumental in forming the hydrochloric acid of the gastric juice by splitting up the sodium chloride. The objection to this theory is that distilled water or mechanical irritation will either of them provoke a flow of gastric juice rich in hydrochloric acid. It is not improbable that lactic acid may serve in a lesser degree than hydrochloric to render functionally active the proenzymes in the stomach.

Butyric acid fermentation also takes place in the stomach, and is under certain circumstances physiological—for instance, when food very rich in milk and carbo-hydrates is taken. It is probable that the formation of butyric acid in the stomach is the work of several different bacteria forms. We have not yet reached finality

in our knowledge of them, since most of the fungi which produce the butyric acid fermentation are anaërobic, and consequently difficult to cultivate in a pure form. The best known and most studied of these micro-organisms is the one described by Prazmowski. It forms rods of 2 to 12 μ in length, which grow either singly or in a long series. Sometimes they assume a zooglœa form. When in the spore-bearing condition the organisms become of ellipsoid shape. The access of air will at once arrest its growth. This butyric acid fungus gives a characteristic reaction with iodine.

We also find acetic acid and yeast ferments in the stomach.

The food having undergone digestion in the stomach is called chyme, and passes through the pylorus into

The Small Intestine.

This chyme will consist of the following constituents :

1. Products of complete digestion in the mouth and stomach, viz., albumoses, peptone, changed gelatin, dextrose, and lævulose.

2. Substances partially digested, that is to say, dissolved, but not yet converted into peptone. In this group we shall find starch, dissolved gelatin, albumin, and the isolated, partially digested, primitive muscular bundles.

3. Matters quite unchanged by saliva and gastric juice such as cellulose, fats, and fatty acids.

4. Fluids which have not been absorbed in the stomach.

5. Saliva, gastric juice, and mucus.

When the mixture has passed into the duodenum it will come in contact with the pancreatic juice, the bile, and the intestinal juice. These are alkaline, and can only act in the presence of an alkali. The chyme as it leaves the stomach has a strongly acid reaction, but becomes alkaline by the time it has reached the lower part of the small intestine.

The Pancreatic Juice is transparent, colourless, odourless, saltish to the taste, and has a strong alkaline reaction owing to the presence of sodium carbonate. It contains four ferments or enzymes, and as it will act upon the constituents of all classes of food, it is the most important digestive fluid that we possess.

1. *It converts starch into sugar*, continuing the action begun by the ptyalin of the saliva in the mouth. Its action, however, is much more energetic, acting upon raw as well as upon boiled starch, the change being effected almost at once at the temperature of the body. This is called its 'diastatic action.'

Until quite recently it was thought that this action consisted of the complete change of the starch into grape-sugar (dextrose), with the formation of dextrin only as an intermediate product; but the researches of Musculus and Mering, among others, have pointed out that the amount of sugar formed is but one half the weight of the starch, and that this sugar is not grape-sugar, but maltose, or the sugar which exists in malted grain. All the rest is dextrin, which cannot be converted into sugar by any further action of the ferments. It is also quite certain that this dextrin and maltose are converted somehow into grape-sugar before they are absorbed into the system, but the precise mechanism by which this is effected we do not know. We know it *is* so, because in the case of diabetic patients who cannot destroy the carbo-hydrates, grape-sugar alone appears in the urine after starch has been eaten, and neither maltose nor dextrin can be found in the blood or in the tissues.

2. *It forms the fats into a fine permanent emulsion.* The mechanism by which this is effected is as follows:

If an ordinary neutral fat, in a perfectly fresh state, be shaken up with a solution of an alkali, no change takes place; but if the fat contains a small quantity of a fatty acid—in other words, if it is slightly rancid—it is imme-

diately emulsified when agitated with an alkaline solution. Now, the first action of the pancreatic juice upon the fat molecule is to cause it to take up three molecules of water and split up into glycerin and fatty acids, the quantity of fat thus acted upon being a very small percentage of the whole amount present in the intestine. This action is due to the presence of a special fat-splitting ferment, and the reason why the whole of the fat does not undergo this change is due to the fact that this ferment exists only in very small quantity in the pancreatic secretion. In most cases this decomposition of the fats begins in the stomach, but here it is effected by fermentation as the result of the agency of micro-organisms, and some observers have imagined that the change in the intestine was caused in the same manner. This, however, is disproved by the fact that the presence of an antiseptic will stop this change in the stomach, but not in the intestine.

When the fat thus mixed with fatty acid comes into contact with the alkaline salts contained in the pancreatic juice, the bile, and the intestinal secretion, it is immediately emulsified, and being thus finely divided, is ready to be taken up by the intestinal epithelium, and passed on into the chyle-vessels. This emulsification is very materially aided by the constant motion communicated to the chyme by the peristaltic movements of the intestine.

3. *Proteids and gelatin-yielding substances are converted into peptone*, and some of this peptone again into leucin and tyrosin. The agent in effecting this transformation is a ferment named pancreatin, or trypsin, which only acts in the presence of an alkali. Mucin and nuclein are also digested to a certain extent.

4. *Milk which has passed through the stomach unchanged will be eurdled*. This may occur in anachlorhydria.

The Bile.—The principal action of the bile is to assist in emulsifying the fat in the manner above described. If

the bile is prevented from reaching the intestine by an obstruction in the duct, or by an artificial biliary fistula, more than half the fat which is eaten reappears in the excreta, which, moreover, are clay-coloured. According to Bunge, this is not entirely due, as has been supposed, to the absence of the colouring matter of the bile, but partly to the masking of the natural colour of the fæces by the fat; for if the light-gray excretion of a jaundiced person be extracted with ether, which dissolves the fat, the dark colour is again evident.

Bile increases the activity of the epithelial cells, whose function it is to absorb the fat. It moistens the coats of the intestine, and gives to the fæces their normal amount of water, so that they can be readily evacuated. Thus bile acts as a natural purgative, especially as it increases the peristaltic movements of the intestine.

The diastatic action of bile, if it exists, is so slight that it may be disregarded for practical purposes, and the antiseptic property which has been ascribed to it admits of another explanation; namely, that when withheld, the excess of fat above described encloses the particles of food, and, preventing them from being acted upon by pancreatic juice, allows them to become decomposed through the agency of the putrefactive organisms of the intestine.

The Intestinal Juice.—The importance of this secretion—which appears to have no action of any importance upon any form of food—its slight diastatic action on boiled starch not manifesting itself until five hours have elapsed—lies without doubt in the very large quantity of sodium carbonate that it contains. It has, first of all, to neutralize the acids of the intestinal contents; not merely the hydrochloric acid of the gastric juice, but also the butyric and lactic acid produced by fermentation, and then, when this is accomplished, to emulsify the fats with its surplus carbonate of soda. For no emulsification of fat can possibly take place until all the acid has been

thus neutralized. And Nature provides for the automatic adjustment of the amount of carbonate of soda secreted, by the law that in the human body acid secretions are increased by alkalies, and *vice versâ*. *Nature always strives to neutralize*. And just as in the stomach the presence of sodium carbonate will reflexly increase the quantity of the acid gastric juice, so the presence of acid in the intestine stimulates the reflex mechanism to pour out a copious alkaline secretion until the intestinal contents become distinctly alkaline. The alkalinity of the intestinal contents appears also to subserve another purpose. When the food leaves the stomach, the hydrochloric acid of the gastric juice is intimately mixed up with the minutest particles of food. When the sodium carbonate comes into contact with the acid, carbonic acid gas is formed, which, having its origin between the particles of food, will mechanically separate them, and thus allow the digestive juices to gain easier and more immediate access to them.

In the Large Intestine.

Here there is very little intestinal juice, and consequently the digestive processes proper are very slight.

All the food which is capable of absorption, and which has not been already assimilated in the small intestine, is absorbed, and the intestinal contents gradually assume a fæcal character. The powers of absorption of the large intestine are very considerable, as not only water and the products of digestion can be thus dealt with, but also substances such as milk, unchanged fluid egg-albumin, flesh juice, and gelatin in solution, when introduced in the form of nutrient enemata. Fermentative and putrefactive processes also go on to a considerable extent in the large intestine, accompanied with the formation of gases, which will be more particularly described when we consider the subject of flatulence.

The amount of fæces is about 170 grammes in the twenty-four hours, and, besides 75 per cent. of water, is made up of the following substances :

1. *Materials derived from Food*.—The residue of animal and vegetable tissues used as food, which are either incapable of digestion, have been imperfectly masticated, or have been taken in too large quantity. Among these we find vegetable cells, muscle fibres, elastic fibres, areolar tissue, starch granules, cellulose, hairs, mucin and nuclein, and crystalline needles of lime, fatty acids and casein.

2. *Formed Elements derived from the Intestinal Canal*, such as red blood cells, leucocytes, and epithelium.

3. *Colouring Matter*, which recent investigations have shown not to consist entirely of biliary derivatives, but also of hæmatin and sulphide of iron.

4. *Products of Fermentative and Putrefactive Processes*, such as indol and skatol.

5. *Micrococci and Bacteria*, which form a considerable portion of normal fæcal matter. These are the moulds, yeasts, and fission fungi.

We may here mention the important part played by cellulose in the formation of the normal fæces. Cellulose was until recently supposed to be entirely incapable of digestion, but from the experiments of Weiske and Knierem it was proved that sheep digested 40 per cent. of the cellulose of sawdust and paper, when eaten mixed with hay, and that human beings digest from 47·3 to 62·7 per cent. of the woody fibres in carrots, cabbage, and celery. Knierem, in another set of experiments upon himself, found that he digested 25·3 per cent. of the woody fibres of lettuce.

But this apparent digestion of the cellulose is not a true act of digestion, but is effected by a fermentative action, probably inaugurated by parasitic bacteria, which simply split up the cellulose into marsh gas and carbonic acid. Cellulose, however, while being hardly of any use

to the organism as food, is yet of the greatest importance, as by its mechanical stimulus it promotes the peristaltic movements of the intestine. If a herbivorous animal, such as a rabbit, be fed upon a diet from which cellulose is completely absent, motions of the bowels absolutely cease, and it dies after a short time from inflammation of the intestine.

To sum up, then, the whole subject :

Saliva contains salivary diastase or ptyalin, and converts starch into dextrin and sugar.

Gastric juice contains

Pepsin, which changes proteids into albumoses and peptones in the presence of an acid ; and the Rennet ferment, which precipitates the casein of the milk.

Pancreatic juice contains

Trypsin, which changes proteids into albumoses and peptones in neutral and alkaline solutions ;

Curdling ferment, which precipitates the casein of milk ;

Pancreatic diastase, changing starch into dextrin and sugar ; and an

Emulsive ferment, which emulsifies and saponifies the fats.

Bile assists in emulsifying the fats.

Intestinal juice, besides neutralizing the acid contents of the stomach, contains invertin, which changes cane-sugar into invert sugar ; and perhaps a curdling ferment.

And the food, in its passage through the alimentary canal, is acted on in the following manner :

1. *The proteids* are acted on by

(a) The gastric juice.

(b) The pancreatic juice.

Albumoses and peptones are formed with some leucin and tyrosin.

2. *Fats* are acted on by

(a) The pancreatic juice.

(b) The bile.

They are partly split up into glycerin and fatty acids, are emulsified and saponified.

3. *The carbo-hydrates* are acted on by

(a) Saliva.

(b) Pancreatic juice.

(c) Succus entericus (very slightly).

4. *All three—proteids, fats, and carbo-hydrates*—are acted on to some extent by the putrefactive processes in the intestines.

5. *Water and salts* are unchanged.

CHAPTER II

INDIGESTION—WHAT IT IS, AND THE CONDITIONS UNDER WHICH IT OCCURS.

Legitimate Use of the Terms Indigestion and Dyspepsia—Conditions accompanied by Disorders of Digestion :—(a) Alterations in the Relations of the Food to the Organism : Imperfect Mastication ; Improper Arrangement of Meals ; Indigestible or Unwholesome Aliments ; Injudicious Admixture of Foods ; Excess of Food ; Insufficient Supply of Food ; Jam and Sweets—(b) Primary Affections of the Stomach : Chronic Gastritis ; Hyperchlorhydria ; Hypersecretion ; Ulcer ; Dilatation ; Cancer—(c) Secondary Affections of the Stomach : Due to Disturbances of the Nervous System ; Occurring in the Course of Anæmia, Chlorosis, Bronchitis, Cardiac Disease, Fevers, Gout, Hepatic Disease, Phthisis, Psychoses, Renal Disease, Syphilis ; Chronic Poisoning by Tea, Tobacco, Alcohol, Opium, Lead, Arsenic, Pus.

WHEN the human body is in perfect health, and the food supplied to it is normal in quantity and quality, the process of digestion is effected unconsciously—we do not know that we have a stomach. But when the digestion of food is accompanied by pain or other disagreeable sensation, either in the region of the stomach or in some other organ of the body ; or when any of the functions of the body are perverted or disturbed, and we can trace a connection between such disturbance and the digestive process, we are said to suffer from indigestion.

Until quite recently it was considered sufficient to make a diagnosis of indigestion, and the practitioner, when he had done this, and excluded cancer, ulcer, acute gastritis, and, perhaps, if he were a very able man, stric-

ture of the pylorus, flattered himself that he had done all that was expected of him for his patient. He then proceeded to prescribe for a condition, of the exact nature of which he was profoundly ignorant. He was perfectly right. The most that could be done with the small amount of definite knowledge which was the common property of the profession was to divide cases of chronic dyspepsia into two groups—those which were accompanied with gastritis, and those which were not. The former he termed ‘irritative’ and the latter ‘atonic’ dyspepsia. But the work of the last few years, and the discovery of improved methods, have placed our knowledge of the different affections of the stomach upon such a footing that no one has now any more right to make a diagnosis of indigestion, and end there, than he would have to make one of dropsy or cough.

When a patient comes to us with either of these conditions we proceed to investigate his case to ascertain the cause of his trouble. Yet it is not so many years ago since a diagnosis of dropsy would have been regarded as justifiable. It has been so, more or less, throughout the whole history of medicine. The *symptoms* of one epoch were the *diseases* of the preceding one. Thus it is to-day with the abnormalities of digestion. The time has now arrived when *indigestion* as a diagnosis must be restricted to cases where, the stomach being healthy, food is so abnormal in quantity, quality, or both, as to produce symptoms during its assimilation. *In all other cases the indigestion will be but a symptom of some definite disease.* We are never justified in making a diagnosis of indigestion when the food is fairly normal. A healthy stomach can cope successfully with food even moderately indigestible. Therefore, the fact that such food causes symptoms must point to some loss of tone, some catarrh, or other abnormality of the stomach, which can be classed under some definite heading.

In such a case it is obvious that 'indigestion' would not be a diagnosis at all. We should merely be telling the patient what he already knew, that his digestive processes were abnormal.

It is, however, very convenient to have a term by the use of which we can intimate that the act of digestion is accompanied by symptoms, without committing ourselves to any theory of their causation. And as such, the words 'indigestion' and 'dyspepsia' can well remain in common use. To be accurate, we may with advantage use either of these terms to signify that certain symptoms are associated in such a way with the digestive process that there shall be a reasonable probability that they stand in some definite relation to it.

As such I shall use them in this book. There are many such symptoms, but it is as well to bear in mind that the patient himself only associates a few of them with abnormality of the digestive process. Probably only pain and other uneasy sensations referred to the stomach region, and such symptoms as flatulence and heartburn. The nerve troubles which arise from the absorption of poisonous products of digestion into the system do not appeal to him in this connection, although just as certainly due to defective digestion. He will come to the physician complaining of giddiness or palpitation of the heart, and will be very much surprised when he is informed that these troubles really point to paresis of the stomach-walls, or some other abnormality in the mechanism of digestion.

These symptoms have as much right to be included in the group we call 'indigestion' as pain after food, or vomiting, since to the educated physician they just as surely point to the possibility of gastric trouble as their cause.

It would be easy to enumerate a long list of phenomena which might, under certain circumstances, point to dis-

order of the digestive process. I do not think that I should by doing so help the reader to obtain a grasp of the subject. It will be better to take the different possible causes of abnormalities of digestion, and discuss them in relation to the mechanism by which they produce symptoms.

The symptoms themselves in their bearing upon diagnosis will be discussed in the chapter dealing with that portion of the subject.

Taking the word 'indigestion,' then, in its broad sense to signify symptoms and signs pointing to abnormality of the process of digestion, we may divide patients who suffer from it into three groups :

1. Those who come to the physician complaining of 'indigestion.' These have uneasy sensations which they themselves associate with the digestive process. Among such we find pain, oppression, dyspnœa, or flatulence coming on so invariably after food that the patient instinctively recognises the relation.

2. Those who complain of symptoms which they themselves do not ascribe to any gastric disturbance. These, however, from their time-relation to meals or other special characteristics, plainly indicate to the physician their probable origin.

3. Those patients who present symptoms which even the physician cannot connect with the digestive processes without a physical examination.

We will suppose that we have come to the conclusion that the patient suffers from indigestion. That is only the first step to our diagnosis. We must find out next what is wrong with the mechanism of the digestive processes. This will be the second step. But we can go still further. There is a third step which we should reach before we can claim to have made a complete and scientific diagnosis. We must find out what is the cause of the abnormality.

An example will make this clear. A patient comes to us complaining of flatulence, constipation, and a feeling of epigastric weight and fulness after food. We say that he has 'indigestion.' That is the first step, but it does not help us much. The patient knows it as well as we do. Yet a great many medical men would stop at this stage, and, contented with this apology for a diagnosis, would proceed to write a prescription. First they would try alkalies and bismuth. If that did no good, then mineral acids. If still unsuccessful, they would prescribe pepsin or papain. But how could it be expected that any good result could be produced, since no real information had been obtained as to the cause of the symptoms? Such practice is sheer guessing. The expert in gastric troubles will proceed to the second step. He will make a physical examination of the patient. Let us suppose that he establishes the presence of dilatation of the stomach. From the character of the other symptoms and the history of the case he decides that this dilatation is due to atony, and not to any mechanical closure of the pylorus. Is there yet anything further to be done? Yes. He will proceed to the third step, and try and find out the cause of the gastric atony. He examines the other organs of the body, and discovers a valvular heart affection. *This is the real disease which he must treat.* All that he might have prescribed for the dilatation of the stomach, the bitters, pepsins, tonics, purgatives, galvanism, etc., would obviously have been of no avail as long as the main cause was undiscovered.

The conditions which may interfere with the normal digestion of food may be placed under the following headings :

- (a) Alterations in the relations of the food to the organism.
- (b) Primary affections of the stomach itself.
- (c) Affections of the stomach secondary to, or accom-

panying, either a disease of some other organ of the body, or depending upon some general morbid condition.

We will discuss these groups seriatim.

A.—ALTERATIONS IN THE RELATION OF FOOD TO THE ORGANISM.

As I have already stated, we are logically compelled to restrict the term 'indigestion' as an ultimate diagnosis to cases where no organic or functional disease can be ascertained to exist. The imperfect digestion is then due to the inability of a *normal* stomach to deal with food abnormal in quality or quantity. If the stomach should be weaker than normal, as, for instance, when it is participating in a general neurasthenic condition, then the indigestion will be merely a concomitant, and the diagnosis must be *gastric neurasthenia*. Likewise, whenever the stomach ceases to be normal—for instance, when the abnormal food has set up catarrh—then our diagnosis must be *catarrh*, not *indigestion*, although the latter would have been admissible in the first stage.

Food which is with difficulty disposed of by a healthy stomach will incommode more seriously a diseased one. We thus see that the study of this portion of the subject is of very great importance.

The following are the principal conditions under which food may produce disorders of digestion :

Imperfect Mastication.—This may be due to—

(a) Undue haste in eating.

(b) Defective teeth.

(c) Conditions of the mouth which prevent the act of mastication from being efficiently performed, such as soreness of the gums and paralysis of the muscles used in chewing.

When this act has been imperfectly performed, the food is not broken up fine enough, and consequently the

saliva, and later on the gastric juice, are not mixed thoroughly enough with it. Moreover, the food being hastily swallowed, the ptyalin of the saliva has not time to act upon the starch before it is neutralized by the acid in the stomach. But a still more important point is this. As we have stated on p. 15, it has been proved by experiment that the presence of the alkaline saliva in the stomach acts as a very powerful stimulus to the secretion of the gastric juice. Now, the normal stimulus to the flow of gastric juice is the act of mastication. So it follows that if the food is not sufficiently masticated, the saliva will not be secreted in sufficient quantity, and consequently one of the usual stimuli to the flow of gastric juice will be absent.

Moreover, imperfectly-masticated food, offering a large surface to be acted on by the gastric juice, will be slower digested, and, besides acting as a mechanical irritant, will, by remaining longer in the stomach, afford increased opportunities for fermentation to take place. It must be borne in mind that the comparative digestibility of different dishes, particularly vegetable ones, is in direct ratio to the facility with which they can be reduced into a homogeneous mass by mechanical means. And it is a distinct advantage that this reduction should take place in the mouth, and be effected rather by the act of mastication than by mashing in the kitchen, since in the former case they become in the process thoroughly mingled with saliva, which is such an important factor in their digestion. It is an important point to bear in mind, therefore, that when from any cause, such as defective teeth, food has to be used which has been artificially broken down, or when soft farinaceous dishes, such as porridge, are taken, they should be kept in the mouth a moment longer than required for the mere preparation for swallowing, in order that they may be well mixed with saliva. It would be a good thing if parents

would train their children when quite young to eat in this manner.

Improper Arrangement of Meals.—The meals may be either crowded too closely together, or there may be too great an interval between them. To take the extremes, we occasionally meet with cases where breakfast is taken at 9, a biscuit or sandwich at 11, lunch at 1, afternoon tea and cake at 4, with perhaps fruit and ices, and a heavy dinner at 6, followed possibly by supper at 12. Or, on the other hand, a breakfast at 8, perhaps no lunch, and dinner as late as 7.30 or 8. Both of these are bad. In the first case the stomach is never allowed the opportunity of emptying itself before the next meal is put into it, and in the second case the whole system is allowed to become exhausted, and when the food is at last taken there is no bodily energy left to digest it, and the appetite has quite vanished. A man in health should be satisfied with three meals a day, and sufficient time—five or six hours—should be allowed to elapse between each, to enable the stomach to completely digest the last meal and get rid of the bulk of it into the duodenum.

Use of Indigestible or Unwholesome Aliments.—The digestibility of any given article of diet consists in the readiness with which it can be acted on and rendered soluble by the digestive juices.

The relative digestibility of different articles of diet apparently depends mainly upon the following points :

1. Their degree of cohesion.

Articles so tough that they cannot be ground up by the teeth pass through the system unchanged, whilst, at the opposite extreme, fluids and semi-fluids are absorbed at once. This is the reason why the flesh of young animals is more digestible than that of old ones.

2. Meat that contains fat interposed between its fibres

is less digestible than the kinds that have not. Beef is an example of the former, mutton of the latter.

3. Within certain limits dilution favours digestibility.

4. Too high temperature of starchy food diminishes its digestibility.

5. Food that has begun to decay is unwholesome, as it contains the poisonous alkaloids termed ptomaines.

6. Some foods, such as certain shell-fish, fungi, etc., contain poisonous alkaloids.

Injudicious Admixture of Foods.—Certain articles of diet, which so react upon each other as to produce an insoluble substance, often cause dyspepsia when taken together. A familiar example of this is a raw egg taken in a cup of strong tea. The albumin of the egg combines with the tannin of the tea, and a dense insoluble precipitate of tanno-albumin, absolutely indigestible and chemically allied to leather (tanno-gelatin), is thrown down. This, although it spoils the egg, vastly improves a common rough tea, and there would be no objection to taking it thus if the egg were strained out and thrown away before the tea was consumed.

Strong tea taken with any meat meal will act in the same manner and convert the albumin into a kind of leather. What is known as a 'high tea' is obviously one of the most unhygienic meals that could have been devised.

Certain articles of diet when introduced into the stomach with the food also appear to have the property of delaying digestion. Wolff has lately investigated the subject, and has arrived at certain results. After administering a Leube's test meal, and ascertaining the length of time occupied by normal digestion, and the degree of acidity at its different stages in the subjects to be experimented upon, he gave them the same breakfast, and at the same time introduced certain articles of diet

and medicinal agents into the stomach. Among his results were the following :

1. *Alcohol*, in quantities not exceeding 20 per cent., slightly increased the secretion of hydrochloric acid and hastened the process of digestion, but in quantities of 30 per cent. or more distinctly retarded peptonization, and diminished the quantity of hydrochloric acid secreted. After a time the presence of food ceased to be a sufficient stimulus to cause the secretion of gastric juice, and continually larger doses of alcohol were required to stimulate its flow.

2. *Coffee* lessened the secretion of hydrochloric acid, and delayed digestion.

3. *Common salt*, given in quantities of 75 grains, lessened the secretion of hydrochloric acid, especially when hyperacidity was present.

It must not be imagined that because tea and coffee delay digestion, their action upon the system must be necessarily injurious. Sir William Roberts has pointed out that this very retardation may prove of real benefit to the individual. By the slowing of the digestive process, the danger of throwing the whole meal, in a peptonized form, upon the circulation will be avoided.

There are, moreover, fallacies to be taken into consideration when we induce digestion artificially in the laboratory, and investigate the action of drugs, etc., upon it. We must bear in mind the processes carried on in the living stomach differ in many respects from imitations of them produced in a test-tube. The stomach can do what a test-tube cannot. It can secure constant movement of its contents ; it can remove the products of digestion as soon as they are formed, and it can continually secrete fresh quantities of gastric juice. This will account for the fact that whilst in the artificial process a pint of claret added to the food will delay digestion for a couple of hours, yet in a healthy person

everything will take place as usual under the same circumstances, the obvious explanation being that an excess of gastric juice is immediately secreted which neutralizes the elaret.

Excess of Food.—An abnormal quantity of food may produce indigestion in two ways, either directly or indirectly. In the former case the food offends by its sheer bulk. In the latter by throwing into the circulation large quantities of nitrogenous material, and thus conducing to gout and gouty dyspepsia.

An adult may consider that he is taking sufficient to keep himself in health if he eats in 24 hours the equivalent of 1 lb. of meat and 2 lb. of bread. All beyond this is not required for the needs of the organism, and in its digestion puts just so much needless work upon the digestive organs. The nearer a man can keep to this amount the better, provided that he has no personal peculiarities of size, occupation, climate, or state of health to provide against. Of course an occasional excess in the matter of diet can do no serious harm, as the digestive organs have a large reserve of energy, and are, or should be, seldom worked up to their limit. But, as a rule, to consume more food than Nature demands throws a large strain upon the tissues whose function it is to eliminate the waste from the system, besides overtaxing the digestive organs. And a man who has always constantly circulating in his blood-current a quantity of nitrogenous substances which are undergoing retrograde metamorphosis is certainly on the highroad to gout and its attendant evils.

Insufficient Supply of Food.—If the supply of food is insufficient the body is imperfectly nourished, and the stomach, participating in the general tissue-starvation, is unable to do its work properly. The diet of bare subsistence, estimated from the mean of prison diets, has been calculated to be 1 oz. of fat, 12 oz. of starch, and

$\frac{1}{4}$ oz. of mineral matters a day, the amount of carbon contained being 7.44 oz. This will just serve to keep a man without activity in a condition of low health.

Use of Jams and Sweets either in Excess or at Improper Times.—This is a very fertile cause of indigestion, especially among young patients. A quantity of jam is often taken at the close of a mixed meal such as breakfast, and thus an abundant opportunity is afforded for abnormal fermentations to be started during the first stage of digestion in the stomach. It is not at all unusual for a breakfast to consist of two cups of well-sweetened coffee, poached eggs, toast well buttered, grilled bacon, jam, with perhaps new bread and plenty of butter. The stomach is thus filled with a diluted, highly saccharine fluid, containing already, if the jam is not very well made or the teeth are carious, plenty of germs ready to set up fermentation on the slightest opportunity.

Can it be wondered at, then, that patients who are thus imprudent suffer habitually from flatulent indigestion?

Another very common practice, especially among children and young ladies, is to fill up the intervals between their meals with eating sweets. That is to say that they are in fact continuously introducing into the stomach during the process of digestion substances which are admirably designed to afford a pabulum for the abnormal ferments present there.

I can call a case to mind as an illustration. A young married lady consulted me some few months ago for dyspepsia accompanied with a great deal of flatulence. She had tried a number of drugs, but without any effect. It came out on questioning her that she habitually ended her breakfast with jam, and in addition often took a slice of bread-and-jam at eleven o'clock. On discontinuing the use of jam altogether her dyspepsia promptly ceased, without the use of any drug whatever.

B.—PRIMARY AFFECTIONS OF THE STOMACH.

Under this heading we shall have :

1. Chronic gastritis.
2. The affections of the stomach accompanied by increase of the hydrochloric acid secretion.
 - (a) Hyperchlorhydria.
 - (b) Hypersecretion.
 - (c) Ulcer.
3. Dilatation of the stomach due to other causes than neurasthenia.
4. Cancer.

1. **Chronic Gastritis.**—This condition interferes with digestion in several ways.

(a) The presence of a considerable quantity of mucus in the stomach sheathes the food, and prevents it from being acted on by the gastric juice.

(b) In children, especially, the mucus which coats the walls of the stomach interferes with absorption.

(c) The congestion of the mucous membrane interferes with the secretion, and alters the composition of the gastric juice.

(d) In cases which have existed any length of time the gastric glands undergo changes, the secreting tubes become shrunken and wasted, are irregular in form and calibre, and frequently undergo fatty degeneration. The epithelium disappears, and is replaced by granules and fat globules. Cysts are occasionally found, which appear to be the result of distension of parts of the tubes which are constricted off from the rest. According to some observers, these changes affect groups of the glands one or two lines in diameter, which are then visible to the naked eye as dull white spots.

2. **The Primary Affections of the Stomach associated with Increase of the Hydrochloric Acid Secretion.**—These diseases are of the greatest interest to us as

practitioners of medicine, first, on account of the frequency with which they are met with in practice, forming as they do a large proportion of the affections generally confounded together under the head of 'indigestion'; and secondly, because we are indebted for the power of differentiating them with certainty to the methods of chemically analyzing the stomach contents that have been devised during the last few years.

The affections of the stomach in which there is an increase of the hydrochloric acid secretion are hyperchlorhydria, permanent hypersecretion, and ulcer.

The first term is the Anglicized form of the French 'hyperchlorhydrie.' I use this word in preference to the translation 'hyperacidity' of the German 'hyperaciditat,' because it implies that the increased acidity is due to HCl, excluding that due to the presence of organic acids. In this affection there is a greatly increased secretion of HCl in the gastric juice, but *only during the digestive periods*.

In permanent hypersecretion the secretion of gastric juice *is continuous, and does not cease during the periods when the stomach ought to be empty*.

Before proceeding to the consideration of these affections, it will be as well to discuss briefly the reasons which exist for including them, together with ulcer of the stomach, in a group by themselves.

Hyperchlorhydria and hypersecretion, as far as I am able to learn, have not been mentioned in any work treating upon the diseases of the stomach until 1882. Even at the present day they are classed under the head of neuroses of the stomach, and summarily dismissed in a few lines by any English authors who allude to them at all. In France and Germany, where the great bulk of the work in connection with them has been done, they are well recognised morbid conditions, and a good deal has been written about them.

Those who class hyperchlorhydria and hypersecretion

among the neuroses are only partially right. There is no doubt but that some cases *are* pure neuroses—such, for instance, as occur in the course of diseases of the central nervous system. Such is the hypersecretion of tabes. But we meet in practice with a number of other cases in which the only nerve disorder that we can surmise is a hyper-irritability of the gastric nerves which control the secreting glands of the stomach, the effect of this being that slight stimuli, which to a normal stomach would be harmless, produce excess in the secretions of the stomach glands. It is obvious, therefore, that we must divide cases of hyperchlorhydria and hypersecretion into two groups:

1. Primary hyperchlorhydria and hypersecretion.
2. Secondary hyperchlorhydria and hypersecretion.

The latter are associated with the general neuroses, and accompanies organic affections of the nervous centres, such as tabes dorsalis.

The former group are of much more importance, and must for clinical purposes be placed in a class by themselves for three reasons:

(a) Being so common, and as I have already stated, accounting for such a large proportion of cases of so-called 'indigestion,' it is a great convenience to have them thus placed.

(b) They are intimately associated. Hyperchlorhydria not unfrequently terminates by becoming permanent hypersecretion. The initial stage of many cases of permanent hypersecretion is frequently simple hyperchlorhydria.

(c) Permanent hypersecretion of any standing is accompanied by a true lesion—a glandular gastritis. This fact of itself is enough to remove it from the class of neuroses.

As regards ulcer, there are now sufficient facts to warrant us in assuming that it is invariably preceded by either hyperchlorhydria or by hypersecretion, and that

it should in reality be regarded as a complication of these two affections, than as an independent disease. In 382 analyses on forty-two cases, Riegel found hyperchlorhydria in all. On the other hand, Gerhardt failed to find it in seven out of twenty-four cases.

This happens to be of no value at all as a proof that ulcer ever occurs apart from hyperchlorhydria, as we know that in both hyperchlorhydria and hypersecretion there are usually periods during which the secretion of gastric juice is approximately normal.

We have every reason to think that ulcer of the stomach is caused by the direct action of the gastric juice upon the walls of the stomach, the following conditions being present :

1. An increased amount of HCl in the gastric juice.
2. An abnormal condition of the blood, as in chlorosis.
3. A direct lesion or weakening of a portion of the stomach wall.

This is usually in the form of a small follicular or other minute hæmorrhage, and may be immediately caused, as is well known, by the withdrawal of normal nourishment from a small area of mucous membrane.

The three conditions, hyperchlorhydria, hypersecretion, and ulcer having thus such close connections, and standing in the causal relations to each other that they occupy, it is not only logical but convenient to include them in a nosological group of their own.

The main characteristic of the dyspepsia caused by members of this group is the presence of severe pain. This can be directly traced to the local action of the hydrochloric acid in the stomach upon walls rendered hypersensitive by continual irritation. The precise character of the pain and other symptoms will be discussed in the chapter devoted to diagnosis.

3. **Dilatation of Stomach due to other Causes than Neurasthenia.**—Dilatation of the stomach may be caused either by paresis of its walls or by stenosis of the pylorus or duo-

denum. The former is usually part of a general neurasthenia, and will be discussed under that heading. Stenosis of the pylorus may be due on the one hand to cancer, ulcer, cicatrices, congenital malformations, simple hypertrophy, tumours, or to adhesions to neighbouring viscera; on the other hand, to spasm. This latter is most commonly met with in cases of permanent hypersecretion.

It is a curious fact that, in order that dilatation may occur, a great degree of narrowing of the pylorus is not necessary. This may be explained by the probability that the muscles in the neighbourhood of the diseased orifices are unable to act in a normal manner, and cannot expel the last particles of food from the stomach. Thus, it can never be really emptied.

Dilatation of the stomach induces dyspeptic symptoms in several ways—

(a) By the fermentation of the retained food. Thus, we shall have flatulence, eructations, together with pain and other signs of irritation.

(b) Reflexly.

(c) By the absorption into the system of toxins produced during the digestive period.

(d) By inducing congestion of the liver.

This portion of the subject will be further discussed in Chapter V.

4. **Cancer.**—The symptoms are mainly produced by the impaired mobility of the gastric walls, and consequent retention of food, by the imperfect elaboration of food due to the defective composition of the gastric juice, and by the local effects of the lesion upon the gastric nerves. In cancer of the stomach the gastric juice is profoundly altered in composition. In nineteen out of twenty-one cases examined by Voinovitch no free hydrochloric acid could be detected in it. The milk-curdling ferment is invariably absent, and in the majority of cases pepsin cannot be found. The absorptive power of the stomach is always diminished.

C.—AFFECTIONS OF THE STOMACH SECONDARY TO, ACCOMPANYING, OR DEPENDING UPON, DISEASE OF SOME OTHER ORGAN OF THE BODY, OR MORBID CONSTITUTIONAL STATE, OR SOME LOCAL OR SYSTEMIC INTOXICATION.

These affections are rarely pure—that is to say, confined to one pathological process. They are usually complex, and depend upon two or more morbid conditions, either concurrent or successive.

This very comprehensive section will include :

1. Affections of the stomach due to disturbances of the nervous system.

2. The stomach troubles which occur in the course of anæmia and chlorosis, bronchitis, cardiac disease, fevers, gout, hepatic disease, phthisis, psychoses, renal disease, syphilis.

3. The gastric troubles set up by the inordinate use of tea, tobacco, alcohol, and opium ; chronic poisoning by lead and arsenic, or the continual absorption into the system of septic pus, either from a pyorrhœa alveolaris or from an abraded cervix uteri.

1. **Disturbances of the Nervous System.**—The alterations of function of the stomach caused by defective innervation may be either due to—

A general neurasthenic condition ;

A local idiopathic neurosis of the stomach ; or to

Reflex irritations from other organs.

Exhaustion of the nerves of organic life, or neurasthenia, is one of the most fertile and ever-present causes of indigestion at the present day. Without a certain amount of nerve-energy, there must necessarily be failure of the two most important conditions of digestion—muscular movements of the stomach and healthy gastric juice. This form of indigestion is often met with in the ill-fed and badly nourished. In the dyspepsia of exhaustion,

the solvent power of the stomach is so diminished that, if food is forced upon the patient, it is almost certain to be followed by flatulence, headache, uneasy and painful sensations in the stomach, and sometimes diarrhoea.

It is an open question at present how far the symptoms of neurasthenia depend upon auto-intoxication by poisonous substances produced in the body itself. It is probable that we have two distinct kinds of neurasthenia, the one depending upon true nervous exhaustion, and the other upon poisoning either by alcohol, tea, or tobacco, or by a toxine produced within the body.

The various symptoms of neurasthenia are now well known to the profession through the writings of Beard and others, and include abnormal sensations in mind and body, exhaustion, palpitation of the heart—in short, symptoms referred to nearly every organ of the body with alteration of function, and, above all, dyspepsia, often in an aggravated form. Other causes of nervous dyspepsia almost, if not quite, as important as neurasthenia, we may mention: hysteria, anæmia and chlorosis, functional disorders of the sexual organs, sexual exhaustion (Beard), diseases peculiar to women, pregnancy, floating kidney (Senator), malaria, and Basedow's diseases.

One also meets with disturbances of gastric function unattended by local disease, caused by different reflex irritations.

The stomach may be disturbed reflexly by lesions in many organs. This fact has been known for many years. Spallanzani excited vomiting in himself by tickling his fauces in the morning before breakfast, when the stomach was empty. After several acts of vomiting had taken place, he obtained a considerable amount of fluid which dissolved meat, and prevented its putrefaction, thus proving that irritation of the fauces produced not only vomiting, but also a secretion of gastric juice. It is well known that sympathetic vomiting is constantly produced

by the reflex irritation of irritative lesions in the brain, liver, or uterus, and also by the passage of gall-stones, and that the vomited matter is generally extremely acid. This acid is evidently a hypersecretion of gastric juice produced by the reflex irritation.

The lesions of the uterus which produce gastric disturbance reflexly are :

1. Cancer of the uterus, the vomiting being frequently attended with thirst and pain.

2. The condition which is present when a miscarriage is about to take place.

3. Chronic ulcer of the cervix.

The vomiting of pregnancy is also undoubtedly reflex, and is supposed to be due to stretching of nerves by the enlarging organ.

A considerable amount of attention has of late been paid to the possibility of gastric affections being set up reflexly by eye-strain. G. M. Gould, in a paper published in 1890 in the *International Journal of the Medical Sciences*, stated that he had found that in the young of either sex eye-strain to any considerable extent often interfered with the digestive process. My own experience bears this out, as I have had in my own practice several cases where digestive troubles appeared to depend upon astigmatism. One patient in particular, a chemist in the City, a highly neurotic individual, used to suffer from great flatulence during the morning hours. I discovered that he was astigmatic, that he lived out of town, and read a paper coming up in the train. He informed me that the flatulence invariably came on as soon as he commenced to read the paper in question. The gastric troubles promptly disappeared as soon as he discontinued reading on his way up to town.

2. **Stomach Troubles accompanying Disease in some other Organ of the Body, or Morbid Constitutional State—*Ague*.**—In a case of paludal cachexia hydrochloric acid

was found to be entirely absent from the gastric secretion.

Anæmia and Chlorosis.—The stomach troubles accompanying primary and secondary anæmia respectively differ in certain important points, and must be taken separately.

Secondary Anæmia: In severe anæmia following hæmorrhage the secretion of gastric juice has been found to be scanty and deficient in hydrochloric acid and pepsin. This only happens if the patient is otherwise in good health. If at the time of the hæmorrhage the patient should chance to be suffering from hyperchlorhydria or hypersecretion, then the gastric juice will continue to contain hydrochloric acid in excess notwithstanding the anæmia.

Primary Anæmia: In pernicious anæmia the total amount of acidity of the gastric juice as estimated by the phenol-phthallein test is usually very low. There is almost always an entire absence of free hydrochloric acid, and only a small proportion of combined acid.

In chlorosis the gastric troubles cannot be attributed entirely to the effect of the anæmia in altering the gastric secretion. A marked neurotic element enters into the case. In most instances there is hyperchlorhydria, but in a few patients the gastric juice has been found to be normal. As a rule the hyperchlorhydria is moderate in amount, and the total acidity not much raised. The chief characteristic of the stomach troubles of chlorosis is the amount of pain which the patients experience. It is usually not so intense as the paroxysms of ordinary hyperchlorhydria and hypersecretion, and simulates rather that found in mild ulcers of the stomach. In practice a great number of these cases are wrongly diagnosed as ulcer. The pain is evidently due to the action of the highly acid stomach contents upon hyperæsthetic nerves.

Bronchitis.—In emphysema of the lungs, the contents of the stomach are often without free hydrochloric acid, and contain only a small quantity of pepsin. It appears that the condition is not constantly present in the same case, but that it is intermittent, and depends upon temporary stasis in the gastric circulation.

This supposition is rendered probable by the fact that it has been observed that the composition of the gastric juice has again become normal where the œdema of lung and dyspnœa have been recovered from. In many patients the stomach troubles of chronic bronchitis resemble those of phthisis.

Fevers.—During an acute illness accompanied by fever the process of digestion is at a standstill. In fevers of any intensity, such as typhoid, the hydrochloric acid is entirely absent from the gastric juice. It reappears when the temperature again becomes normal.

Gout.—Gout is without doubt a very frequent cause of dyspepsia, and acts in two different ways, producing two distinct forms of stomach disturbance :

1. It may produce a chronic inflammatory condition of the coats of the stomach, precisely in the same manner as it does in other tissues of the body. The resulting symptoms will resemble those due to ordinary chronic catarrh.

2. It may produce flatulent distension of the stomach, coming on two hours or so after a meal. This appears to be directly caused by deficient secretion of bile. The antiseptic action of the biliary secretion being absent, and also its stimulating effect upon the peristaltic movements of the duodenum, the food will remain there and ferment. In consequence, the food in the stomach, being unable to escape into the already overloaded bowel, will also undergo fermentation, attended with the evolution of gas.

Heart-Disease.—The affections of the stomach which

attend valvular disease of the heart must be divided into two groups, those accompanying the early stages of heart disease, and those which are met with much later on. We may term them respectively the initial and the late gastric troubles. As they differ essentially in character, we must consider them separately.

Initial Gastric Troubles: These usually are in the form of gastric neurasthenia, and are the results of atony of the stomach walls with consequent dilatation. The immediate cause is probably a central one, and produced in some way by the abnormality in the circulation. These stomach troubles often come on quite early in the course of a valvular disease of the heart, and it is for these that the patients consult us in most instances. They are not aware that they have heart disease until we inform them of the fact. In their own opinion their case was merely a stomach trouble when they entered our consulting-room. Unfortunately, when they leave it they know that they have heart-disease. The effects produced by this particular form of gastric disorder will be described later on.

Gastric Troubles accompanying the Later Stages of Valvular Disease: These are due in most instances to passive congestion of the stomach as the result of the interference with the systemic circulation. The symptoms are those usually to be met with in gastric catarrh, with the addition that absorption from the stomach is materially interfered with. As a rule there is marked deficiency in the quantity of HCl secreted. As this form of digestion is accompanied with secondary fermentations and great flatulence, the dyspnœa and palpitation are much worse during the digestive period. At a later stage vomiting and diarrhœa are common, and help to give the *coup de grace* to the patient.

Hepatic Disease.—The stomach is more in relation with the liver than with any other organ of the body,

and we have good reason to think that an intimate connection exists between their functions.

If the secretion of the liver is defective, the functions of the stomach are invariably disordered.

The most usual cause of liver derangement is want of the proper correspondence which should obtain between the amount of food we eat and the fresh air that we inhale. An excess of rich and highly alcoholic food requires the blood to be very perfectly oxygenated to dispose of the *luxus consumptionis*. This will not be the case, as we can readily see, if the circulation and respiration are deficient owing to sedentary habits—too little exercise, or confinement in hot, badly-ventilated rooms. Want of exercise will also diminish the metabolism of the body by inducing renal and intestinal torpidity, with consequent retention of urea, uric acid, bile, and other morbid products. These waste materials, entering the blood by the hepatic veins, probably produce all that train of uneasy nerve sensations in the dyspeptic not immediately due to the toxic effects of the *leucomaines* formed by the digestive process or to reflex irritation.

Derangement of the liver may also possibly act in helping to render possible the establishment of the vicious circle. We now know that it is probable that one very important action of the liver is to act as a trap to intercept poisonous products of digestion and prevent them from entering the circulation. Given a dilated stomach with abnormal fermentations going on in its cavity, if the liver be unable to arrest the poisonous substances therein produced, they will enter the circulation and perpetuate the neurasthenia which was the primary cause of the dilatation of the stomach.

Phthisis.—Dyspepsia is often one of the first signs of phthisis, and many patients lose their appetite and become constipated long before any other symptoms occur.

From the researches of Chelmonski, it appears that in the course of chronic phthisis there is often found an absence of free hydrochloric acid and a very small amount of pepsin. He believes that this depends sometimes on anæmia of the stomach, due to general debility and chronic fibrous endarteritis, sometimes on passive hyperæmia of the stomach, and occasionally on amyloid degeneration of the mucous membrane and of the arteries. The results arrived at by Schetty appear to establish the fact that the dyspepsias of phthisical patients do not always depend upon gastric catarrh and a diminution of the secretion, and corroborate those of Immermann, who comes to the conclusion that in most cases of phthisis which are attended with dyspeptic symptoms there is nothing wrong with the quantity or quality of the gastric juice, and consequently that the perversion of function must be attributed to disorder of the nervous system.

On the other hand, Grusdew found that in thirty-six out of sixty-four patients examined, there was no free hydrochloric acid at all, and in addition made out the fact that the quantity of hydrochloric acid was lowered in direct proportion to the severity of the disease. Brieger also, as the result of a number of examinations, states that in cases of severe phthisis he only found normal gastric juice in 16 per cent., and that in all the others it was profoundly altered. In 10 per cent. the normal constituents of the juice were almost entirely absent. In cases not so advanced the gastric juice was not so frequently altered, but in most was by no means normal. In commencing phthisis about half the number of patients exhibited abnormalities in the gastric juice. He also found that both the motor power and the absorption from the stomach appeared to be diminished in direct ratio to the abnormality of the gastric juice. In contradiction to Immermann, he believes that these changes depend upon gastric catarrh, and later on, atrophy of the gland structure.

However, summing up these observations by different experimenters, I think the weight of evidence, without doubt, points to the fact that the stomach disturbances in phthisis—at least, after the first stage—are in most cases due to profound alterations in the gastric juice, in the direction of insufficient quantity of its active ingredients; and that these alterations depend—at least, in some instances—upon catarrhal inflammation of the mucous membrane of the stomach. And, moreover, in advanced cases we may have associated both dilatation and thinning of the organ with consecutive atrophy of its glandular secreting tissue.

The diarrhœa, which is frequently so distressing a complication of the later stages of phthisis, may result from mere catarrh or from coincident ulceration, generally tubercular, of the intestine itself.

Among the earliest and most important of the disturbances of the digestive organs associated with phthisis we must place *vomiting*. This is often the first thing which brings the patient to consult the physician; and many cases are known where medical men have committed the serious mistake of overlooking the constitutional disease and ascribing the ailment to some primary gastric affection.

In phthisis we meet with three kinds of vomiting:

1. We meet with it in the early stages of the disease, coming on at the end of a paroxysm of coughing. Here it is manifestly the direct result of the act of coughing irritating the vagus nerve, and precisely resembles the vomiting constantly met with in whooping-cough.

2. It is, however, much more common to meet with it at a later period of the disease, when it is attended with loss of appetite and uneasy sensations referred to the pit of the stomach. Here it is obviously of gastric origin.

3. In advanced phthisis, especially in women, we may find compression of the pyloric end of the stomach by an enlarged fatty liver. We shall have as the result nearly

the same train of symptoms as arise from pyloric stenosis, but not to the same extent.

Psychoses.—It appears to be established that the greater number of patients suffering from melancholia are the subjects of hyperchlorhydria. The total acidity of the gastric juice varies from 2·8 to 4·0 per 1,000. The digestion of albuminoids is consequently very active, and as in addition the peristaltic movements of the stomach are in excess, that viscus empties itself much quicker than normally into the duodenum. In paralytic and senile dementia the opposite state of things obtains, the quantity of hydrochloric acid being often less than normal.

Renal Disease.—In chronic Bright's disease there are several conditions which tend to disturb the stomach. When the kidneys cannot do their work the blood becomes contaminated by retained morbid products, which should have undergone elimination.

1. The gastric juice may become vitiated from actually containing urea. This is not a mere speculation, as it has been found that urea is present in the vomited matters in malignant cholera and other diseases associated with temporary diminution of the renal function. There is very often diarrhoea alternating with the vomiting, and produced, like the latter, by the irritation set up by the vicarious elimination of the urinary products.

2. The constant drain of albumin from the system produces an asthenic condition, and the stomach, participating in the general debility, is unable to perform its functions efficiently.

3. In renal calculus we frequently find disorder of the stomach, which is evidently reflex and caused by the constant irritation in the kidney.

Syphilis.—Syphilitic lesions of the stomach are extremely rare, and when present simulate cancer or ulcer. We have no means of making a diagnosis except from the

history and by observing the beneficial effects of specific medication.

It is, however, quite common to find functional disorders of digestion occurring during the secondary period. This is especially the case in women. The symptoms are identical with those of gastric neurasthenia, and are usually vomiting, nausea, flatulence, anorexia or bulimia.

3. Gastric Disorders the Result of Intoxications.—We have already discussed the rôle played by the poisonous toxines of digestion in the production of gastric neurasthenia. We have now only to consider the disturbances of digestion caused by the introduction into the system of poisons from without.

Alcohol. — We have already (p. 34) alluded to the fact that more than a certain quantity of alcohol taken with food will retard digestion, but independently of its immediate mechanical effect upon any particular meal, alcohol forms one of the principal causes of gastric disease as it is met with at the present day. It is unfortunately the fact that the reprehensible practice of taking stimulants between meals is an extremely common one in the age in which we live. It is not usually for pure self-gratification and indulgence, but rather as a stimulus to mental exertion, that spirits are taken in this manner. In a healthy organism, when a certain quantity of work either of mind or body has been performed, a sense of fatigue or weariness is perceived which compels the individual to cease for a time his labour and allow time for Nature to recuperate the organism. Alcohol simply deadens this sense of weariness, and enables the man to go on working without feeling how tired he really is. Stimulants never increase the natural capacity of the brain. They can only abstract for the purposes of work in hand some of the energies which are sorely needed to repair and to restore a brain

which has already been taxed to the furthest limit which is consistent with health. To remove the sense of fatigue caused by overwork by the consumption of alcohol is to close one's ears to the voice of Nature. The weariness of the brain is a protest against further exertion until recuperation has been obtained by rest, and if the weary feeling be deadened or destroyed by adventitious means Nature will exact her penalty. Exhaustion of the brain is most dangerous when it cannot be perceived, and the man who deliberately rouses his jaded faculties to excessive exertion by alcoholic excitement makes a call upon his reserve energies which he often finds it difficult to repay. And the nervous exhaustion which is thus produced is accompanied in many cases by severe forms of functional dyspepsia.

Another manner in which alcoholic excess tends to set up dyspeptic disturbance is by its local action upon the coats of the stomach. Alcohol, particularly when only slightly diluted (as, for example, in the form of gin-and-bitters), acts as a direct local irritant, and tends to set up gastric catarrh when taken upon an empty stomach.

The dyspepsia of beer-drinkers is caused in a little different manner. Here it is not so much the alcohol which does the harm as the introduction into the stomach of large quantities of cold (perhaps iced) liquid, often containing acetic acid. Thus, the gastric contents are too much diluted, the nerves of the stomach are inhibited by the cold, and acetic acid fermentation is possibly set up.

Lead.—Persons exposed to the slighter degrees of chronic poisoning with this metal usually exhibit marked dyspeptic symptoms. Loss of appetite, constipation, and gastric uneasiness are common. There is often slight jaundice, and nearly always anæmia. In severer cases the well-known 'lead colic' occurs. As this often is

worse in the evening and at night, it may be mistaken for the gastralgia of hypersecretion.

Arsenic.—This poison acts by setting up a chronic gastritis. In smaller and longer-continued doses it may induce degeneration of the secreting epithelium of the gastric glands.

Opium.—The effect of opium or morphia, either introduced into the stomach or injected subcutaneously, is to diminish the secretion of gastric juice and the muscular movements of the stomach.

Pus.—There is good reason to believe that many of the chronic indigestions which come under our notice are due to the continual absorption of pus into the system either from a pyorrhœa alveolaris or from an abraded cervix uteri. This is especially the case among the lower classes, who are careless about the condition of their mouths. The subject is at present undecided, and offers a valuable field for further investigation. In such cases we should expect to find some of the other signs of the absorption of toxins, such as pigment spots on the arms, tachycardia, goitre, neuritis of the sixth left intercostal in women, and peptonuria. Urticaria or some other skin eruption may also be present.

Tea.—As a cause of indigestion this is most frequently met with among females in the lower classes. These are often in the habit of drinking large quantities of tea at all times. In addition to the action of the tannin therein contained on the albuminous constituents of food, mentioned on p. 33, excessive tea-drinking produces indigestion—

1. By its action upon the nervous system. Here it acts very similarly to tobacco.

2. By diluting the contents of the stomach below the point of concentration required for the efficient action of the gastric juice.

3. Moreover, large quantities of hot fluid frequently

introduced into the empty stomach tend to keep up a condition of dilatation not at all conducive to the performance of its functions.

I must say that I am unable to agree with Dr. Saundby in his belief that tea-drinking is not responsible for much of the dyspepsia amongst women of the lower class, and that improvement does not follow its discontinuance. My experience is diametrically opposed to this. I have been able to trace a very great number of such cases to the abuse of common, badly-made tea. The majority of these could not be cured as long as the habit was continued, but readily recovered under the same treatment when it was abandoned.

But it is in neurasthenic subjects that tea is most injurious. To many of these tea in any quantity is a poison. I have under observation at the present time a gentleman who invariably suffers acutely after indulging in a single cup. About an hour afterwards he will experience a feeling of great oppression, with difficulty of breathing and pain in the throat. These symptoms are immediately due to a stomach dilated with wind. This flatulence cannot be the result of fermentation, as sufficient time has not elapsed since the food was taken. It is produced in some manner through the agency of the nervous system. The dyspnœa is so intense that the patient often feels as if every breath would be his last. On several occasions he has burst out into a cold sweat, and has actually fainted. These symptoms are, I believe, identical with those described by French writers under the name of the *syndrome de Potain*.

Tobacco.—Excess in smoking is a relative term. Whilst some people are exceedingly tolerant of tobacco, others can only use it in the extremest moderation without experiencing its ill effects. There can be no reasonable doubt but that dyspepsia is very often produced by

its use when taken in a quantity which is excess to the particular individual. It acts in two ways: first, by its general depressing effect upon the nervous system; and, secondly, by its local action upon the nerve-terminals in the stomach.

We often meet with clinical proof of this in practice. A patient comes to us with marked dyspeptic symptoms, slightly furred tongue, and perhaps tremulous hands. On inquiry we find that he smokes several cigars between each meal. We restrict his allowance to one cigar after dinner, and he is soon quite well without any other treatment.

I think there can be no doubt but that tobacco can produce real chronic inflammation of the stomach. This is particularly the case in those who chew it. This is also certainly the case with smokers, especially those who indulge before breakfast or on an empty stomach. Anyhow, the habit of smoking may prevent a catarrh of the stomach from improving under treatment, although possibly it may not have caused it in the first instance. I have frequently been struck with the fact that in practice I have been unable to cure patients with chronic gastritis as long as they continued smoking, although they had put themselves upon a rigid diet as to food and alcohol.

I have observed an immediate action from tobacco in several cases of gastric neurasthenia. [There is hardly a neurasthenic patient whom tobacco does not make worse, and most of them try to smoke.] The effect I allude to is a pain in the left mammary region, with a feeling of pressure. This is relieved by the eructation of some wind. I have known it follow a single strong cigar.

Having read so far, the reader will doubtless have gathered that to find out the nature of the cases of so-called indigestion which come to consult him he must

be able to diagnose and differentiate between all the common diseases of the stomach. Therefore, any book which professes to deal with the subject at all scientifically must take into consideration and discuss the majority of them.

Whilst not professing to have made this book a complete treatise on diseases of the stomach, I shall endeavour to supply the student with sufficient information to enable him to deal in a satisfactory manner with the different cases of digestive troubles which may come under his notice.

After describing the methods of examining the patient, a short description will be given of the commonest diseases of the stomach, with special reference to diagnosis.

CHAPTER III.

THE INTERROGATION OF THE PATIENT.

The Questions to be asked the Patient—The Facts which may be elicited, and their Bearing on the Case.

IN this chapter the questions to be asked the patient will be enumerated, and the bearing of the answers obtained will be discussed.

In order to arrive at a correct diagnosis, it is of the utmost importance to conduct the investigation in a systematic manner. This is necessary both in order that no point or fact bearing upon the case may be accidentally omitted, and also that time may not be wasted in asking irrelevant questions. One must know what to ask, and what not to ask. Nothing is more striking than the difference to be observed in the respective methods followed by the expert and the novice in the investigation of a case in any special department of practice. The former asks every question with a view to elicit some special piece of information; the latter, not knowing the points, only arrives at a diagnosis at the cost of a vast number of unnecessary questions and a corresponding waste of time.

The following is the arrangement which I usually adopt in my own practice in investigating cases of derangement of the digestive organs.

The examination of a patient may be divided into two parts: First, the Interrogation of the Patient, or what

he can tell us about himself. This may be subdivided into *The History of the Case* and *The Present Condition of the Patient as regards Subjective Phenomena*. Second, the Objective Signs of Disease that we can observe for ourselves on a Physical Examination.

This chapter will deal with the first part—

THE INTERROGATION OF THE PATIENT.

We must elicit the following facts :

A.—THE MEDICAL HISTORY OF THE PATIENT ANTERIOR TO THE PRESENT ILLNESS, AND THE FAMILY HISTORY.

B.—THE HISTORY OF THE PRESENT ILLNESS.

The age of the patient.

The precise date when the indisposition commenced.
It is sometimes rather difficult to arrive at this, as patients are often very perverse, especially hospital out-patients, and require to be cross-examined as if in a witness-box before they can be made to give a direct answer. Moreover, as disorders of digestion are frequently gradual in their inception, it is not at all an easy matter to fix in every case the exact time when they first began to make their appearance. This difficulty may usually be overcome by asking the patient the question, 'How long ago is it since you were quite well?'

The manner of its access. Did it come on suddenly or gradually, and in what manner? What were the first symptoms noticed?

The supposed cause, such as a chill, fright, or excess of any kind.

The subsequent course of the illness, with the order in which the symptoms appeared.

Whether the stomach affection has altered in character, or are the symptoms of the same kind as at first?

Has there been loss of flesh? If so, has the decrease in weight been continuous, or have there been intervals in which a certain amount has been regained?

These facts having been ascertained, you can proceed to investigate the present condition of the patient.

C.—THE PRESENT CONDITION.

The leading symptoms at the present moment, viz., the particular discomforts or painful sensations which have impelled the patient to consult you to-day.

The condition of the patient on rising in the morning. Is he languid or refreshed? Is there any pain or uneasiness of any sort? Is there nausea or vomiting? If there be vomiting, is it moderate in amount and composed of mucus, bile, or saliva? or is it more abundant, consisting of an acid liquid containing particles of undigested food?

The condition of the appetite. Is it normal or abnormal? If the latter, is there complete loss of appetite, is it capricious, or, there being loss of appetite, does it return after a little food has been taken? Is there increase of appetite? Is there a normal appetite which disappears after a little food has been taken? Is there a feeling of satisfaction after food or not?

Is there a disagreeable taste in the mouth? If so, describe it. Is it constant or variable?

Does the patient suffer from excessive thirst?

If the appetite be abnormal, ascertain if this is so at meals, or only at certain ones.

The usual arrangement of the patient's meals, with the quantity and kind of food taken at each. Amount of alcohol, tea, coffee, and tobacco taken. Is eating or drinking between meals a usual circumstance?

Sensations referred to the gastric region.

(a) *Feeling of pressure or oppression.* The exact spot where it is felt. Does it come on after eating, or quite independently of taking food? When it follows food, how soon afterwards does it come on? How long does it remain?

(b) *A feeling of fulness after food.* Is it present at other times as well as after food? Is it limited to the epigastrium, or does it extend over the whole abdomen? Has the quantity of food anything to do with its intensity? Does it come on after a small meal the same as after a large one? Is it more pronounced after a meal of animal or vegetable food? Does it immediately follow a meal, or does it come on a little time afterwards?

(c) *Actual pain.* Character or description of the pain. The precise area over which it is felt. Its point of maximum intensity. Does it change its position from time to time? Has it any connection with meals? If so, is it experienced before, during, directly after, or some time after meals? Is the pain relieved, increased, or uninfluenced by taking food? Does pressure relieve or increase the pain? Are there any spots painful to pressure? Is there any pain in the back? If there is, make out its character, the precise spot where it is felt, its time relation to meals, and whether it is increased or relieved by pressure.

Flatulence. Does it come on after meals, or when the stomach is empty? If after food, how long after? Does it observe any degree of periodicity? Does it follow any particular article of diet? Is it accompanied by other symptoms, such as headache, difficulty of breathing, faintness, or pain in the neck?

Eructations. Are they slight or severe, noiseless or explosive? Are they acid, bad-smelling, bitter, or tasteless? Are particles of food brought up as well? Do they occur during the process of digestion, or independently of it?

Is there pyrosis or regurgitation ?

Vomiting and nausea. Is there nausea, or is there actual vomiting? If there is nausea, at what time in the day is it experienced? Is it ever followed by actual vomiting? If there is vomiting, does it take place when the stomach is empty, or only after food? If the latter, how long after food, and after which meals? How often does it take place? Do the attacks occur in periodic groups, with intervals free from vomiting? Is it preceded by pressure, fulness, pain, or cramp? Does the act of vomiting relieve the pain or discomfort? Is there blood or bile in the vomited matters, and if so, is such invariably the case? What is the colour, taste, and smell of the vomited material? When vomiting takes place on an empty stomach, at what time of the day or night does it usually occur?

The condition of the bowels. Is there constipation? If so, are the bowels eventually opened of their own accord? If not, what kind of assistance is usually given (purgatives, injections, etc.)? If the stools are abnormally frequent, of what character and daily number are the stools, and does any particular article of food or drink bring them on? Does the patient suffer from hæmorrhoids?

The condition of the urinary organs. Never omit to inquire into the integrity of these whenever the patient is a man above middle age.

Are there any **symptoms** present which would lead one to suspect the possibility of commencing phthisis?

Are there symptoms of derangement or disease of the heart?

Are there any symptoms present of organic disease or functional derangement of the nervous system, such as lightning pains, tingling, numbness, twitching, spasm, cramp, loss of power, flushes of heat, giddiness, globus, morbid fears, etc.?

Inquire into the **environment** of the patient as to fresh air, exercise, work, recreation, etc.

This rather formidable list of questions will enable us to pretty well extract all we can from the patient, and we can now proceed to examine the absolute condition of his digestive organs by the different means at our disposal.

But before describing the methods of doing this, it will be advisable to take these questions seriatim, and consider the possible facts which they may elicit, and their bearing on the case. This was not done in the earlier part of this chapter in order to keep the scheme as concise as possible. I shall therefore recapitulate the questions to be asked the patient, expanding and discussing each one separately. The next chapter will deal with the objective condition.

A.—MEDICAL HISTORY OF THE PATIENT PRIOR TO PRESENT ILLNESS.

Family History.—Certain faulty conditions of the nervous system are liable to be transmitted from parent to child. In many cases the inheritance of a faulty nervous organization is apt to show itself in defects of the digestive functions. This is especially liable to happen at the present day, from reasons growing out of our modern civilization. The inordinate mental activity, the active competition, the struggle for mere existence, the haste to get rich, the disappointment of failure—all these characterize the age in which we live, and contribute to this end. It is, therefore, obvious that the existence of a neurotic family history, or the reverse, may materially assist our judgment in obscure and doubtful cases.

Previous Illnesses.—It is important to inquire very carefully into these, first, because the present trouble may possibly be the ulterior result of some anterior affection ;

and, secondly, for the reason that what the patient considers to be a distinct malady may have really been an early stage of that from which he now suffers.

B.—HISTORY OF PRESENT ILLNESS.

Age of the Patient.—Each period of life has certain affections of the stomach especially associated with it. In adolescence and youth we find more particularly the neuroses of sensation and muscular movement; later in life, anomalies of secretion; later still, organic affections, such as chronic catarrh and cancer. The stomach becomes weak as age advances, in common with all the other functions of the body. As a consequence of this, there ensues diminished excitability of the gastric nerves, attended with impaired muscular action of the walls of the stomach and deficient secretion of gastric juice. Chronic structural changes are also apt to occur in advanced life; the gastric glands become atrophied, and the arteries atheromatous. It is, on the other hand, a curious fact that many neurasthenics appear to grow out of their stomach troubles. As they advance in years, they lose the dyspepsia which tormented them in their younger days.

Date of the Commencement of the Present Illness.—It is a matter of the first importance to ascertain the exact duration of gastric troubles, as diagnosis is thereby much assisted. For instance, an affection which has persisted for some few years is hardly likely to be cancer, the duration of which hardly ever exceeds eighteen months.

Manner of Access.—The manner in which an affection of the stomach commenced will often indicate, with a certain probability, the group to which it belongs. Nervous vomiting, gastralgia, hyperchlorhydria and hypersecretion very often begin quite suddenly. The onset of chronic catarrh, cancer, and ulcer is usually slow

and insidious. It is, unfortunately, often a difficult task to obtain a reliable history of the case from the patients themselves. Their recollections of the beginning of their illness are usually vague and imperfect. They remember with much greater detail the different patent medicines which they have unsuccessfully tried, or the names of the physicians whom they have consulted.

Possible Cause.—Under this heading we place the conditions under which the malady began. That is to say, the personal habits of the patient at that time and antecedent to it, and his environment. We must carefully inquire for any of the causes which are known to be adequate to produce the affection from which we believe him to be suffering. The subject of the causation of gastric disease has already been discussed in the preceding chapter. I will here only add a few remarks to what has already been said.

Excess in food, alcohol, or highly-spiced dishes, imperfect mastication, or bolting the food, are common causes of chronic catarrh and hyperchlorhydria.

Many cases of gastric neurasthenia or nervous dyspepsia commence during the convalescence from an acute illness, such as typhoid or influenza.

Anger, fright, and other powerful emotions, undoubtedly cause gastric neurasthenia in certain individuals. It is not unusual to obtain a previous history of excessive brain-work or worry, or deprivation of sleep, in cases of hyperchlorhydria or hypersecretion.

It is not uncommon to be unable to obtain a history of anything which could possibly have caused the gastric affection. In cancer this is especially the case.

Subsequent Cause of the Illness up to Date.—By following carefully the course of the patient's malady we can often at once make a probable diagnosis, or, at least, we can eliminate certain diseases. For example, cancer and permanent hypersecretion very much resemble each other

in the phenomena which they produce. But they differ in the fact that pain and vomiting, the two most characteristic symptoms in both of these affections, are relieved by treatment in hypersecretion, but not in cancer. In hypersecretion, moreover, there are frequently spontaneous intermissions. When, therefore, a patient presenting these symptoms tells us that the progress of his case has been marked by intermissions, either spontaneous or produced by treatment, we may safely assume that the disease is most certainly not cancer, and very probably permanent hypersecretion.

Certain stomach affections come on in distinct attacks, separated by periods of perfect health. These will most probably be neuroses.

One should always inquire what medicines have been taken, and their effect, as by so doing we may often gain valuable hints for diagnosis.

For instance, if the patient's trouble has been habitually relieved, or even cured for a time, by large doses of alkalies, it will almost certainly belong to the group in which the gastric secretion contains an abnormal amount of hydrochloric acid—hyperchlorhydria, hypersecretion, or ulcer. If alkalies never do any good, then you have very probably to deal with a case of gastric neurasthenia.

If hydrochloric acid relieves the patient, he is probably suffering from some defect in the gastric secretion, such as we find in gastric neurasthenia.

Alterations in Character of the Symptoms.—We shall find that these will usually be due to successive stages of the same malady. For example, in a case of cancer we shall first of all get no vomiting. Later on, when stricture of the pylorus has been established, and dilatation of the stomach has taken place, vomiting will be a frequent symptom. Later still in the history of the disease the vomiting will cease, because the stomach will participate in the general enfeeblement of the patient,

and its walls will be unable to contract sufficiently to expel its contents.

Emaciation.—In estimating the true value of progressive loss of flesh for purposes of diagnosis, one must bear in mind two things: the amount of food habitually consumed by the patient, and the possible existence of some local or general malady, of which the gastric disturbance may be merely a secondary manifestation. Many patients with disorders of digestion, acting under medical advice or of their own accord, restrict their diet to such an extent that it is unable to support the body in normal health. Emaciation necessarily ensues.

Weight is not usually lost in the early stages of chronic gastric catarrh. It is not until atrophy of the secreting mucous membrane has taken place that there is any marked interference with nutrition.

In ulcer of the stomach and the severest form of gastric neurasthenia emaciation may be quite as much a feature as in cancer.

Hyperchlorhydria, as a rule, is not accompanied by loss of weight; but, on the contrary, emaciation invariably ensues in protracted cases of hypersecretion.

As a general rule, loss of flesh may be taken as a rough measure of the gravity of the gastric trouble. This is not to be wondered at when we take into consideration the important part played by the stomach in the maintenance of the integrity of the organism.

C.—PRESENT CONDITION OF THE PATIENT.

Leading Symptoms at the Present Moment.—These are the symptoms which have induced the patient to invoke medical aid. They are what he will spontaneously answer to the question, 'What do you complain of?' It is important to get these in the patient's own words, and enter them in the notes of the case before you

proceed to ask any leading questions. Otherwise, among the host of symptoms which you will probably elicit from the patient by your cross-examination, you will run the risk of losing sight of the more pronounced ones. Uneducated people, especially out-patients at hospitals, will often assert that they suffer from everything that you ask them about. They imagine that the more symptoms they have, the greater interest will be taken in their case. I have found that you can usually get out of this difficulty by only crediting the patient with those troubles of which he makes *unhesitating* confession. If he stops to think ever so slightly, the veracity of his answer may be suspected. For instance, you ask, 'Have you headache?' After thinking awhile, he will answer, 'Yes.' Cross-examine him, and you will find that he had it once some months ago. If he suffers habitually from it now, *he will not have to stop and think.*

Condition on rising in the morning with respect to

Languor, pain, and nausea or vomiting.

In chronic catarrh, dilatation with retention, permanent hypersecretion of long standing, and severe nervous dyspepsia, patients rise in the morning unrefreshed, tired, and often feeling more exhausted than when they went to bed. Sufferers from gastric neurasthenia often complain of a feeling of sinking or all-goneness, and suffer from faintness, giddiness, and sensations of emptiness in the head. These morbid sensations usually vanish as soon as breakfast has been taken.

Patients with hyperchlorhydria and hypersecretion tell us that the period before breakfast is their best time in the whole day. Their stomachs being more or less empty, their pains are absent.

We are all, I suppose, familiar with the morning sickness of chronic alcoholism. This is often excited by the act of brushing the teeth.

The Condition of the Appetite, including Thirst and Taste—*Alterations in the Appetite.*—In indigestion the appetite may range from absolute anorexia, or complete loss of appetite, through various grades up to bulimia, in which the sense of hunger is experienced in its highest form. In many cases the appetite is perverted, and unnatural inclination exists to eat either articles of diet forbidden by the physician, or strange and abnormal substances which in a state of health would excite disgust.

Loss of Appetite.—This is a symptom in most diseases of the stomach, and varies much in degree. Its cause is probably complex, and depends partly upon the presence of dead epithelium upon the surface of the digestive tract—the common association of a furred tongue and loss of appetite being familiar to us all—and partly on the condition of the nervous system.

Anything which will make a profound impression upon the latter, such as bad news, anxiety or fear, especially just before food, will often cause the desire for it to entirely cease for a time. It is usually the expression of nerve trouble, and is especially frequent in young people and women—in the latter, doubtless, on account of their tendency to hysteria. In hysteria and neurasthenia the anorexia often forms the real disease. Loss of appetite may consist only in an absence of desire for food, or the consciousness of a dislike for food. The latter is often met with under normal circumstances, and can be overcome by an effort. Or it may amount to an absolute disgust for food in any form, accompanied by a feeling of nausea at the idea of eating. In my experience absolute loss of appetite is more frequently found in functional disturbance than in real organic disease.

Excess of Appetite often occurs physiologically in young, rapidly-growing individuals if too long time

elapses between meals, and must be distinguished from bulimia, or an abnormal sensation of hunger. The latter differs from the former in being often very intense and accompanied with the greatest suffering and other symptoms, such as dulness and drowsiness, headache, malaise, sweating, tremor, and a feeling of oppression or pain in the epigastrium.

Abnormal Sensation of Hunger (Bulimia) is a symptom of many diseases, and various serious affections are occasionally accompanied by it.

This symptom may be either acute or chronic, and may either be—

1st. A pure neurosis of the stomach.

2nd. The result of hysteria.

3rd. The result of exhaustion of the whole body caused by either long and severe disease, general neurasthenia, or worry.

4th. As a sequel to an attack of acute gastric catarrh.
Or a concomitant of

5th. Diabetes.

6th. Intestinal worms.

7th. Disease of the mesenteric glands.

8th. Basedow's disease.

9th. Menorrhagia.

10th. Phthisis.

11th. Neurotic increase in the stomach movements.

As an example of bulimia, we may quote the following case recorded by Peyer: A lady, æt. 32, after a prolonged period of worry and trouble, was suddenly attacked with a sensation of misery at the epigastrium, which rapidly developed into a feeling of hunger, so intense as to be absolutely painful. She at once drank three pints of milk, but without relief, and her symptoms increasing in intensity, she feared that she was about to die. Within an hour she had taken three pints of milk, twenty-three eggs, and two pints of wine. At last she became ex-

hausted and fell asleep. In the morning following she was quite well, and did not have any repetition of the attack.

Chronic cases of bulimia are not uncommon, and present a feeling of satisfaction directly after food; but the hunger soon returns, and if food is not again taken, great distress ensues. It is a curious fact that, notwithstanding the large quantity of food which these patients consume, they often emaciate.

Most of the patients affected with bulimia suffer from many other symptoms of abnormal irritability of the nervous system. In fact, it may be taken to be an expression of excessive irritability of the centripetal nerves which regulate the sensation of hunger.

Whilst on the one hand bulimia often is the local expression of a nerve disturbance, yet it may possibly be a complication of a true organic disease of the stomach.

One must be careful in practice to distinguish bulimia from polyphagia, which latter means simply eating and drinking to excess. This condition, which is observed in a mild degree in diabetes and in convalescence from acute diseases, is present under some circumstances to a very high degree in lunatics, and occasionally in epilepsy, hysteria, hydrocephalus, and tumours of the brain. Rosenthal mentions a case which occurred in a patient suffering from severe neurasthenia.

As regards the variations of the appetite, for practical diagnostic purposes we may note—

1. The appetite is generally deficient in severe organic disease of the stomach, in cancer and atrophy of the mucous membrane.

Also in the severest forms of chronic gastritis and amyloid degeneration of the coats of the stomach, the appetite is temporarily lost or directed towards forbidden articles of diet.

2. In dilatation (due to pyloric stenosis) the appetite is usually normal, or even voracious; but in temporary dilatation of the stomach due to chronic catarrh, where there is abnormal fermentation of the stomach contents, notably among drunkards, there is often entire temporary loss of appetite.

3. In ulcer of the stomach the appetite is generally normal. Indeed, you may get increased desire for food, particularly in the intervals of pain. But as the sequelæ of ulcer develop (stenosis of pylorus, dilatation or cancer), the appetite will gradually diminish.

4. The loss of appetite observed in neurasthenics is of quite a different character. In a typical case of this description you will often find a very good appetite suddenly vanish after one or two mouthfuls of food have been taken. The stomach feels as if already filled, and there is often a sense of heavy weight at the epigastrium.

In these cases the appetite, like the mental attitude of the patient, is easily elevated or depressed.

Alterations in Taste are very generally present in affections of the stomach.

There may be a sour or bitter taste in the mouth, or it may be unpleasant, foul, or pasty. The immediate cause for this is probably the varying conditions of the epithelium in the mouth.

Thirst.—The variations in the sense of thirst are of less diagnostic value than those of appetite. Thirst is, as a rule, increased in affections characterized by excess of gastric secretion. This is notably the case in permanent hypersecretion, where it may approach very nearly that observed in diabetes. Thirst is generally increased in the following conditions :

Gastric catarrh of urinary origin in elderly men. It is here very intense, and accompanied by anorexia and dryness of the tongue.

Acid secondary fermentative processes in chronic gastritis and in *chronic gastric catarrh* of alcoholic origin.

Thirst is diminished in certain forms of neurasthenia.

The Arrangement of the Patient's Meals.—In any case where flesh has been lost, it is of extreme importance to know what the patient habitually eats. It is quite possible that such emaciation may be simply due to a restricted diet. In order to extract the required information from a patient, I find that it is usually best to request him to say exactly what he has had to eat at each successive meal during the last two days. Otherwise the patient will deal in generalizations only, and you will never get a clear idea of what he really does consume.

The amount of fluid taken must be carefully inquired into, since the abuse of drinking at meals is a common cause of indigestion in young people. In cases where absorption from the stomach is defective, the ingestion of large quantities of fluid may either set up or perpetuate dilatation of the stomach.

Sensations referred to the Gastric Region — *Feeling of Pressure in the Epigastric Region.*—This is a symptom that one meets with in nearly every disease of the stomach, and for this reason is not of much use for diagnostic purposes. It varies in intensity with the amount of disturbance of the digestive functions. In its mildest form it consists of merely a slight feeling of oppression, which is quite endurable, and gradually diminishes during the progress of gastric digestion. In its severest it may continue for hours. In some cases it appears in the intervals between meals, when the stomach is empty. Under these circumstances there is frequently no apparent disturbance in the digestive function. A symptom also very common, and generally associated with the preceding, is a *feeling of fulness*.

This often comes on after a little food has been taken,

and the patient experiences the sensation of having made a hearty meal when really he has hardly eaten anything.

Actual Pain.—The following are the chief diagnostic points which enable us to discover the meaning of the pain in the case under consideration :

Gastric neurasthenia: the pain is dull and heavy, localized at the epigastrium, and comes on one or two hours after food, or directly after. There is, as a rule, no tenderness, no vomiting, no hæmatemesis, tongue clean, no tumour, patient may be any age and of either sex.

Chronic gastritis: pain is a burning soreness, sometimes augmented by food, felt behind sternum, sometimes going through to the back and radiating round to the left; constant, but comparatively slight; comes on two or three hours after food, the amount of pain varying with the degree of inflammation. It is very slight in cases of mild catarrh, whilst in very acute catarrh the introduction of food into the stomach may set up severe pain at once. There is frequently some local tenderness. Often some retching, no hæmatemesis, tongue furred, no tumour, any age, either sex, usually constipation, free HCl, no dropsy, not much emaciation, no cachexia.

Ulcer: pain referred to the epigastrium just below the ensiform cartilage, increased by pressure, and relieved by vomiting or the passage of food into the duodenum. It is boring, tearing, burning, or stabbing, and usually very severe. Sometimes it is felt in the back, between the eighth dorsal and second lumbar vertebræ; comes on immediately after food, usually vomiting, usually abundant hæmatemesis, tongue clean, no tumour, age generally under thirty, usually female, usually constipation, HCl in excess, no dropsy, frequently extreme pallor and debility.

Cancer: cutting pain in the epigastrium, frequently radiating, rarely remits. Comes on one or two hours

after food. There is usually tenderness and vomiting, but hæmatemesis not very abundant, tongue variable, there is generally a distinct tumour, age generally over forty, male sex, obstinate constipation, no HCl, often œdema of ankles. Gradual progressive loss of flesh and debility, sometimes cachectic hypertrophy of peripheral lymphatic glands, especially above the clavicle.

Periodical attacks of gastralgia, which are occasionally met with in practice, are of the greatest diagnostic and prognostic interest, as they may be either the precursors of locomotor ataxia, or the gastric crises of the same, or may be simply neuroses of the stomach. In the last case they sometimes occur when the stomach is empty, and are relieved by taking food.

Gastralgia is further discussed on page 193.

For diagnostic purposes we should carefully bear in mind the following points connected with gastric pain :

1. Pain coming on *soon* after a meal is very often due to organic disease of the stomach. This probability is strengthened if it ceases when digestion is finished or vomiting takes place.

2. On the other hand, in nervous or hysterical people with no serious disease we not unfrequently get severe pain *directly* after a meal

We infer that the pain is probably a neurosis when we meet with it in cases of impoverished blood or enfeebled health, especially if there are disorders of the uterus or ovaries, or neuralgic pains elsewhere. The best guide is the condition of the digestive apparatus in the intervals between the pains. Disordered digestion, epigastric tenderness, nausea and vomiting, are not seen in simple neuroses.

3. Pain coming on *two or three* hours after a meal, and lasting several hours, is usually due to hyperchlorhydria.

4. One must be careful not to confuse pain in the abdominal muscles with gastric pain.

5. Aneurism of the aorta and incipient disease of the dorsal vertebræ, pleuritis, intercostal neuralgia, abscess of liver, intestinal disorders, colic, disorganization of the tissues of the kidney or pancreas, and the passage of gall-stones or renal calculi, may all give rise to pain in the epigastrium.

6. The nearer the pain is to the middle line, and the more fixed and confined to a small spot, the more likely is it to be gastric, and probably a serious malady.

7. If pain is persistent and severe, and associated with tenderness of the epigastrium, there is nearly always a morbid state of the tissues of the stomach. A mere uneasy sensation may be neurotic, or be due to chronic gastritis. If worse after a heavy meat meal than a light farinaceous one, it is almost always structural.

If it occurs only when the stomach is empty, and is relieved by food, it is almost certainly neurotic.

8. Spasmodic attacks of pain may be due to chronic organic disease, but are more generally neuralgic. A great help to diagnosis is the fact that there is a predisposition to such attacks of a purely neuralgic character among gouty, rheumatic, debilitated subjects, among women who are anæmic, and men exposed to exhausting influences.

When such a predisposition exists, the actual attacks are brought on by exposure to cold and damp, violent emotions, and flatulence in the intestines. These seizures often alternate with neuralgic or spasmodic affections, such as asthma or angina.

Spasms.—A patient, particularly among the uneducated classes, probably in the out-patient room, complains of ‘spasms,’ perhaps ‘round the heart.’ What does she mean? For it is usually a woman.

She may be trying to describe either—

1. Increased cramp-like peristaltic movements of the stomach and intestines ;
2. Gastrodynia ; or
3. Simple flatulence, impeding the movements of the diaphragm and heart.

Besides these so-called spasms, there are two conditions met with in dyspeptic patients which are *really* clonic spasms.

1. Hiccough. This consists of clonic spasms of the diaphragm, caused in many cases by the presence of undigested food in the stomach.

2. Fibrillary twitching in the orbicularis muscle of the eye, or occasionally in other muscles. This latter never, in my experience, happens unless the dyspepsia is associated with lowered nerve-tone from excessive smoking, tea-drinking, or excesses of other kinds.

Flatulence.—This is a very common and distressing symptom, and occurs both in gastric neurasthenia and in chronic gastritis. It is usually caused by the fermentation of the contents of the stomach and intestines as the result of the multiplication of specific organisms with the attendant evolution of gases. These gases consist of carbonic acid, sulphuretted hydrogen, hydrogen, nitrogen, and the hydrocarbons. The hydrogen and nitrogen are produced by the bacteria which set up the butyric acid and acetic acid fermentations, but the marsh-gas is formed incidentally during the solution of the cellulose taken in the vegetable matters used as food. This digestion of cellulose, as we have explained, is effected by a process of fermentation. Cases have been recorded where the gases issuing from the mouth have proved themselves to be inflammable by accidentally catching fire.

In cases of extreme flatulence the stomach contains *torulæ*, *sarcinæ*, and multitudes of other vegetable

parasites. The gas-forming organism, moreover, appears to be a bacillus. It can be isolated and cultivated in Pasteur's fluid. Gas is freely evolved, which burns with a blue flame, and is probably marsh-gas. The organism grows in an acid medium, and consequently can develop in the acid contents of the stomach. The reason why it does not grow in the healthy stomach is probably because its contents are removed before there has been sufficient time for this to take place. Hence, we can see why, in cases of dilatation of the stomach, and where the muscular movements are insufficient, it should develop in abundance.

On the other hand, more frequently than has been supposed, in cases of gastric neurasthenia, flatulence is of nerve origin, and may occur when the stomach is empty. In nervous people, who, as a rule, digest their food rapidly, we sometimes meet with cases where, after we may presume the stomach has emptied itself into the duodenum, attacks of epigastric pain come on, attended with sudden flatulent distension of the stomach and bowels. This condition is generally relieved by again taking food. But, nevertheless, the fact that taking food gives relief rather favours the hypothesis that even in these cases the evolution of gas may be due to an organism, and that the organism is destroyed by the antiseptic gastric juice which would be secreted as soon as food entered the stomach.

We must not forget that attacks of pain, with vomiting and flatulence occurring when the stomach is empty, are occasionally pre-ataxic signs.

As the result of flatulence we mention an exceedingly distressing symptom from which many dyspeptics suffer, viz., *dyspnœa*, or *difficulty in breathing*.

This is produced very often by the distended stomach pressing up and impeding the descent of the diaphragm, and tilting the heart up out of position. In young sub-

jects whose arteries are elastic, the heart is often displaced upward so much that the apex beat may be felt an inch or more above its normal position. I have even seen it beating in the axilla when the patient was lying upon the left side. If the heart is weak, *flatulence may be really dangerous*. It is a fact not appreciated to the extent that it should be, that to all those who have weak hearts a stomach much distended with wind is a most dangerous complication. Mere gastric flatulence, super-added to the existing cardiac trouble, has been known even to cause sudden death. I believe that this is the true explanation of many of the instances where patients suffering from chronic heart disease, having retired to bed in their usual health shortly after partaking of a hearty meal, have been found dead in the morning.

The pressure upon the heart, together with a recumbent position upon the left side, have combined to produce this result.

It is probable that in many of these cases of dyspnœa there is temporary dilation of the right side of the heart.

In other cases the dyspnœa appears to be due to irritation of the fibres of the pneumogastric nerve which are distributed to the stomach.

This is also the cause of the *palpitation of the heart* which is occasionally observed in dyspeptic subjects. This palpitation in its mildest form consists of a simple tumble or jump of the heart occurring occasionally. In its severest form it is a source of great distress.

Syncope, or fainting, is not unfrequently the result of a distended stomach, and is due to irritation of the inhibitory fibres of the same nerve. In my experience I have observed it more often where the stomach was overloaded with solid food, than when merely distended with wind. The patient has suffered most probably from

slight nausea and loss of appetite for several days, with perhaps sensations of faintness, which he has taken stimulants to relieve. After a rather hearty meal, with perhaps a little more tea or claret than usual, he faints, and, vomiting, brings up not only what he has eaten at the time, but semi-digested articles of food taken at preceding meals. It is a curious fact, pointing to irritation of the pneumogastric nerve as the exciting cause of the fainting, that the patient is often aware, just before losing consciousness, of an aura or pain in the neck along the course of the nerve.

Minor degrees of irritation will produce intermittency of the pulse, and it is a peculiarity of this form of irregularity of the heart's action that a beat is completely left out, the pulse-trace descending below the level, and the next ascent being correspondingly higher.

Eructations.—This phenomenon may be met with in two conditions :

(a) As a sign and accompaniment of abnormal gastric fermentation.

(b) As a neurosis of movement.

In the former case its occurrence is limited to the digestive period, and the gas eructated has usually a distinct taste and smell. It is also sometimes inflammable. In the latter, it may occur at any time in the day quite independently of the process of digestion. The eructations are tasteless, and consist evidently of atmospheric air that has been swallowed. This variety is met with in the neurasthenic and hysterical.

Pyrosis, Regurgitation, and Acidity.—Pyrosis is a condition which usually comes on in the morning on an empty stomach. It often commences with pain in the epigastrium, increased by movement. After this has continued for some little time a thin colourless fluid is brought up, which is alkaline, and usually tasteless, and varies from one to several ounces.

It strikes red with ferric chloride, and converts starch into sugar. There appears to be no doubt that it really is saliva, which, secreted in abnormal quantity, and arrested by spasm of the cardiac orifice of the stomach, gushes back into the mouth. Sometimes an attack terminates in actual nausea and vomiting, when the ordinary contents of the stomach are brought up. Waterbrash occurs in three conditions:

1. Where there is no indication of gastric disease, the patients being usually neurotic women, suffering from pelvic irritation or pregnancy.

2. Where the attacks of waterbrash are traceable to offending food in the stomach.

3. Where there is evidently actual disease of the stomach, and the symptom occurs indiscriminately after every kind of food.

It is believed that pyrosis is always a true reflex act, and caused by irritation in the stomach, or in other organs, such as the uterus and ovaries. In many patients dilatation of the stomach and muscular insufficiency, as estimated by Ewald's salol test, can be demonstrated.

Regurgitation consists in the bringing up of fluid, or even solid particles of partially-digested food, into the mouth, and is only very seldom of much diagnostic importance. In its simplest form it is merely eructation of fluid; but rare cases have been noted where undigested food was brought up into the mouth, masticated, and swallowed afresh. When the matters which are brought up into the mouth are intensely acid, setting the teeth on edge, we know that there is excess of acid in the stomach, and by the proper tests we can ascertain (see p. 125) whether the acidity is due to hydrochloric or to organic acids.

Heartburn is a sensation of heat and constriction either in the epigastrium or the throat, and is caused by the irritation of the mucous membrane of the cardiac

end of the stomach, and the lower end of the œsophagus by the acids contained in the gastric contents.

Patients often complain of a sensation of 'clutching' at the throat, and describe it *as if the throat were fixed in a vice*. This latter sensation is due, in all probability, to irritation of the terminal fibres of the vagus nerve. It is most often met with in cases where neurasthenia is the fundamental cause of the dyspepsia, and where we should *a priori* expect to find a condition of abnormal irritability of the pharyngeal and gastric nerves.

Heartburn is very frequently met with where abnormal fermentative processes are going on in the stomach, generally in cases of acute and chronic gastritis and dilatation of the stomach.

In most instances it undoubtedly points to increased formation of acid in the stomach contents, either due to excessive production of the organic acids as the result of fermentative changes, or to a real increase in the amount of hydrochloric acid in the stomach. Occasionally, especially in neurotic patients, we find heartburn without any increase in the acidity of the stomach contents. It is probable that in these cases there are abnormal fermentative processes present, the products of which, although not acid, are of an acid nature.

Vomiting and Nausea. — The consideration of the symptom vomiting is of the highest importance in making a diagnosis between functional disturbance and organic disease of the stomach.

It may be caused in any of the following ways :

1. Irritation of the terminations in the stomach of the afferent fibres of the pneumo-gastric nerve by
 - (a) Acute or chronic inflammation of the stomach.
 - (b) Ulcer of the stomach.
 - (c) Cancer of the stomach.
 - (d) Alcoholic drinks.
 - (e) Irritating substances, such as undigested food, in the stomach or hyperacidity of its contents.

2. Dilatation of the stomach produced by
 - (a) Paralysis of its muscular walls.
 - (b) Narrowing of the pylorus, from
 - (1) Malignant disease.
 - (2) Spasm.
 - (3) Fibroid disease.
3. Narrowing of the œsophagus.
4. Central irritation produced by Bright's disease, or by disease of the brain.
5. The reflex irritation of pregnancy, or stretching of a duct.

We have in any given case to find out what is its cause, and the following facts will help to guide us to a conclusion :

1. If vomiting occurs in a person in good health, we must suspect either an attack of acute indigestion, or that something irritating has been swallowed. We should in these cases, however, not forget that a violent emotion is occasionally a cause.

2. If the food is expelled immediately it is swallowed, we must look for :

- (a) Constriction or spasm of the œsophagus.
- (b) Constriction of the cardiac orifice of the stomach.
- (c) Great irritability of the stomach.
- (d) Some irritation in some other organ of the body leading to sympathetic vomiting.
- (e) Hysteria.

3. If the vomiting never occurs, except soon after food has been taken, and then gives immediate relief from pain which came on after the food had been swallowed, we should suspect cancer or ulcer.

4. If vomiting occurs about three hours after a meal, and is preceded by severe pain which is relieved by it, we are a'most certain to have a case of hypersecretion before us. This is more especially so if it happens in the middle of the night.

5. If the vomiting takes place many hours after digestion has commenced, it is probably due to narrowing of the pylorus, with its accompanying dilatation of the stomach.

6. In ulcer of the stomach it usually occurs soon after a meal, and generally in the course of a typical attack of pain, and when this pain has reached a certain height. As soon as the stomach is emptied, all pain is at an end for the time being, or a slight burning sensation may be experienced for a few minutes longer. It is a remarkable fact that, as a rule, vomiting does not make its appearance until the severe pain has been experienced for some weeks.

7. In brain disease there is usually an absence of nausea and retching. The act of vomiting occurs quite independently of the taking of food, occurs often when the patient is in the erect position, and may be excited by sudden movements of the head.

8. In Bright's disease there is usually diarrhoea associated with the vomiting.

9. In dilatation of the stomach and pyloric stenosis vomiting generally occurs whilst digestion is at its height, and not unfrequently in the course of the following night.

10. In chronic catarrh of the stomach the vomiting very often commences two or three hours after the meal, and is preceded by a feeling of epigastric pressure and by nausea, which latter may even have commenced before the meal was terminated.

11. In alcoholic dyspepsia the sickness occurs in the morning on first rising, and is often excited by brushing the teeth.

In addition to the information afforded us by the time when the vomiting occurs, we can derive further diagnostic hints from noting the quantity, odour, taste, and composition of the vomited material.

Quantity.—If the vomiting be often repeated and copious, we have in all probability to deal with a case of stricture of the pylorus. In one other condition we meet with very abundant vomiting—in permanent hypersecretion attended with dilatation of the stomach. In a case lately under my observation, from one to two quarts were brought up nearly every day.

Odour.—1. Odour of putrefaction indicates putrefaction of albuminoids in the stomach.

2. Odour of rancid butter is often present in butyric acid fermentation.

3. Faecal odour signifies that probably the vomited matter comes from the intestine.

Taste.—1. Bitter taste shows that peptones are formed in excess, and we have probably a case of hyperchlorhydria.

2. Nauseous taste. This is common in chronic catarrh and in dilatation, with deficient secretion of hydrochloric acid.

Composition.—The ingredients which are important from a diagnostic point of view are, mucus, bile, water, food, and blood.

Mucus in excess indicates catarrh of the stomach, either primary or secondary. We are all familiar with its presence in the morning vomit of drunkards. We must, however, be on our guard against one cause of fallacy. It is possible for it to come from catarrh of the pharynx or œsophagus.

Bile is present as an accidental ingredient in most vomited matters, especially after excessive retching. Under these circumstances it is of no consequence. But when the vomit consists almost entirely of bile, the probability is that there is present either some obstruction in the duodenum or some displacement of the stomach. In the former case we shall find pancreatic juice mixed with it.

If the patient brings up very large quantities of liquid, he probably suffers from hyperchlorhydria or hypersecretion. In the latter affection the amount vomited not unfrequently is far in excess of the total quantity of fluid ingested during the same period. This will account in a great measure for the emaciation which is so marked a feature. As regards the differential diagnosis between hyperchlorhydria and hypersecretion from the character of the vomit, we may lay down the following rule, which is applicable to most cases: If the patient brings up a moderate amount of watery liquid, with a bitter acid taste four or five hours after a meal, he probably suffers from hyperchlorhydria. If the quantity is much greater, and contains food-residues, he has most likely permanent hypersecretion. The latter probability is much increased if the vomiting occurs during the night.

Food-residues are contained in the vomit in stricture of the pylorus, cancer, ulcer, permanent hypersecretion with retention, in catarrh, and in certain neuroses affecting the stomach walls. The careful examination of the vomited matter will materially assist us in differentiating the one from the other. It is first of all obvious that, if we find the residue to consist mainly of undigested meat, the gastric secretion must be deficient in hydrochloric acid. If we find chiefly undigested bread or vegetables, then the opposite is probably the case, since we know that HCl inhibits the digestion of starch. To come to particulars. In *catarrh* we shall find that the residue consists mainly of partially digested meat. The vomit is usually moderate in amount. In *cancer* the meat is still less digested. In *hypersecretion* and *hyperchlorhydria*, as we might expect, the residue almost entirely consists of unaltered bread and vegetables. In *dilatation of the stomach depending upon stricture of the pylorus*, the fact of the meat being digested or not depends upon whether this condition is accompanied by hypersecretion.

Blood may be present in the vomit under the following circumstances :

Commonly in

(a) Cancer and ulcer. (Ordinary form of ulcer.)

Less frequently in

(b) Permanent hypersecretion.

(c) Congestion of the stomach due to cardiac, pulmonary or hepatic disease.

(d) Hysterical vomiting.

(e) Gastric crises of tabes.

(f) Tubercular and syphilitic ulceration of the gastric mucous membrane.

(g) Miliary aneurisms of the minute arteries of the stomach.

Nausea is a symptom which usually accompanies the act of taking food, but has also been observed during the height of the digestive process, or even on an empty stomach in cases of disturbed innervation of that organ. In this latter connection it has not unfrequently been observed in bulimia, hysteria, and gastric neurasthenia. In these cases the distress is relieved directly by taking food.

But nausea, occurring as it does in so many different conditions, is not of much practical value in diagnosis. It is not at all an uncommon symptom in the different forms of catarrh of the stomach, cancer of the stomach, tapeworm, in dilatation of the stomach and abnormal fermentative processes, also in anæmia and its associated dyspeptic symptoms. Nausea may either exist as a symptom by itself, or may accompany the act of vomiting.

Nausea before breakfast is a characteristic sign in the catarrh of alcoholism. Of all diseases of the stomach, those least often associated with nausea are hyperchlorhydria and hypersecretion.

The Condition of the Bowels—Constipation.—This is

an almost universal accompaniment of gastric neurasthenia, and is one of the commonest complaints met with at the present day. There is a great difference in the frequency with which healthy people have an action of the bowels. Some people have a motion more than once a day, others only twice or so a week. And these variations need not be pathological. When, however, the usual number of evacuations is departed from, and at the same time discomfort is experienced, we must consider the condition as abnormal and calling for treatment.

The causes of constipation accompanying disorders of digestion are :

1. Deficiency in the peristaltic movements of the intestines, generally associated with deficiency of bile.

2. Excessive dryness of the fæces.

3. Restriction of diet. This is a very frequent result of the 'dieting' which patients often undergo for the cure of their indigestion. One can have a too digestible diet. By carefully leaving out of your diet list all articles which are indigestible, the normal stimulus of the intestinal movements is absent, and it is no wonder that constipation ensues. This fact, as we have pointed out, has been very experimentally verified, as rabbits from whose food cellulose was entirely withheld became constipated, and very soon died of inflammation of the bowels. It is, therefore, not difficult to understand why dyspeptic patients who live on lean mutton chops and dry toast should be habitually constipated. Many derangements of health follow a torpid state of the large bowel. The poisonous alkaloids produced by the abnormal fermentations going on in the retained contents are absorbed, and, poisoning the nervous system, perpetuate the dyspepsia. So a vicious circle is established which it is very hard to break. As symptoms produced by constipation, we have mental depression

—sometimes reaching the most severe hypochondriacal conditions—furred tongue, offensive breath, and loss of appetite. Also persistent nerve-pains in the back, hip, groin, or thigh, and many other symptoms simulating the antecedent states of structural diseases of the nerve-centres.

Diarrhœa not unfrequently accompanies indigestion. It is often associated with a congested state of the liver, and may be regarded as a natural curative measure. Excessive irritability of the muscular walls of the stomach, associated with weak digestion, will hurry the food out of the stomach into the duodenum before it is properly digested. Here it will by its presence increase the peristaltic action of the intestine, and a form of diarrhœa will be the result, the undigested food being found in the evacuations.

The same effect is also produced by irritating articles of food, such as oatmeal. It is a common delusion that oatmeal porridge is the most wholesome thing that can be taken for breakfast. The real state of the case is the exact opposite. If you examine a grain of oats under the microscope, you discover a rough and bristling structure. You find that the grain is covered with a fibrous, shaggy coat, with dust and insects' eggs stored away in its meshes. This is composed very largely of silicious material, useless for food and injurious to the mucous coats of the digestive tract.

This is quite incapable of being acted upon by any of the digestive juices; in fact, nothing less than a caustic alkali or a mineral acid will dissolve it. It is therefore absolutely unchanged by any amount of cooking or boiling to which the oatmeal may be subjected. By its scrubbing and irritating action upon the lower bowels, it acts as a cathartic. And then, after a time, the mucous membranes become accustomed to this abnormal irritation, and constipation ensues. The physiological

stimulus of ordinary food is no longer sufficient to excite the peristaltic movements of the intestines.

Diarrhœa may sometimes occur as the result of acute duodenal dyspepsia. In acute gastric dyspepsia, the acid decomposing mass which passes the pylorus completely neutralizes the alkaline secretions of the duodenum, and thus the remaining fats, starches, and undigested proteids decompose instead of being digested. Absorption is arrested, and the offending mass quickly setting up increased peristaltic movements, diarrhœa is the result. This is familiar to us all as the diarrhœa which accompanies acute indigestion.

The Condition of the Urinary Organs.—It is one of the commonest errors in practice to overlook the urinary origin of some forms of gastro-intestinal disturbance (see p. 143).

The converse holds good, as gastric troubles are not unfrequently the earliest symptoms of chronic nephritis or diabetes.

Cardiac Symptoms.—There are several possible conditions :

1. There may be organic heart disease which has caused secondary gastric catarrh by interfering with the return of blood from the stomach, or reflexly (see p. 47).

2. There may be a primary gastric affection which has set up secondary derangement of the heart. This may be either reflex or caused by toxine poisoning.

3. There may be functional derangement of the heart, as a manifestation of the neurasthenia which has also caused the gastric trouble.

The symptoms to be looked for are, palpitation of the heart, dyspnœa on exertion, intermittence of the heart, pain in the cardiac region, giddiness, and faintness.

Symptoms of Derangement or Disease of the Nervous System.—Under this heading we must look for :

1. Symptoms of organic nerve disease, such as tabes, of which the gastric trouble may be a manifestation; lightning pains, double vision, tingling or numbness of feet, vertigo, deafness.

2. Symptoms of general neurasthenia. These are manifold. The chief ones are: Insomnia, flushing, drowsiness, bad dreams, pain, pressure, or heaviness in the head, noises in the ears, mental irritability, desire for stimulants and narcotics, fear of lightning, fear of responsibility, of open or closed places, of society, of being alone, of being afraid, of contamination; deficient mental control, lack of decision in trifling matters, hopelessness; sensitiveness to cold or heat or changes in the weather; pains in the back, heaviness in the loins or limbs, localized peripheral numbness and hyperæsthesia, difficulty in swallowing, convulsive movements on going to sleep, feeling of profound exhaustion, ticklishness, vague pains and flying neuralgias, local or general itching, flashes of heat, cold hands or feet, excessive gaping and yawning, vertigo, trembling of muscles.

3. Symptoms of hysteria: Globus, excitement, foolish or unseemly behaviour, frequent micturition, hysterical breathing, etc.

Many of the foregoing symptoms may be either the result of a stomach trouble or a sign of a general condition which may have set up the gastric disorder.

I shall take a few and discuss them seriatim, with reference to their bearing upon the digestive process.

A very considerable number of the symptoms met with in indigestion may be referred to the nervous system. It is extremely probable that the abnormal sensations and functional nervous disturbances experienced by the dyspeptic during the process of digestion are due to the absorption into the system of alkaloids which are actually generated in the stomach and intestines. Some of the

best work in the elucidation of the mode of action and formation of these substances has been done by Brieger. He pointed out that alkaloids are formed in putrefying meat analogous to those occurring in plants during growth. From decomposed meat he isolated two poisonous substances, choline and neurine, and from putrid fish an alkaloid which he named muscarine, as it appeared to be identical in action with the muscarine found in certain fungi, and, like it, was antagonized by belladonna. He also discovered that, under certain conditions, a poisonous alkaloid was actually formed during the digestion of fibrin by pepsin. This he termed pepto-toxin, and showed that it had an action like curare.

Mental Depression.—It is a well-known fact that the process of digestion, when delayed or imperfectly performed, is often accompanied by a feeling of depression, which may vary from an extremely slight uneasy sensation in the head to a most intense melancholy. There is very little doubt that these sensations are caused by the absorption into the system of those poisonous products of imperfect indigestion which have been already alluded to under the name of leucomaines. This explains the marvellous effect of a dose of blue pill in such cases. It is a matter of common observation that a smart mercurial purge will often entirely alter the aspect of things in general. After a good evacuation from the bowels, life, which before looked full of gloom, again appears worth living, and troubles which seemed unbearable now become things to be laughed at. The purge has washed away the decomposing material from the large bowel, and the morbid substances which have been already absorbed are quickly eliminated through the urine.

Drowsiness.—This symptom is not unfrequently present during imperfect digestion, and usually comes on an hour or two after meals, when the digestion in the

intestine is commencing, and, like the mental depression, is due in all probability to the absorption into the system of the poisonous products of digestion.

Sleeplessness.—This is most commonly caused by the presence of lumps of undigested food in the stomach, which, by keeping up a reflex irritation of the brain, render continuous sleep impossible. Another way in which dyspepsia produces sleeplessness is through the mechanism of a dilated stomach—as a rule, not a permanently dilated viscus, but a temporary condition due to a spasm of the pylorus, which prevents the stomach from emptying itself. This spasm is usually due to reflex irritation of the pylorus by stomach contents containing abnormal quantities of lactic, acetic, butyric, or hydrochloric acid. The patient has most likely dined out; has taken a considerable quantity of champagne or claret with a dinner of larger dimensions than usual. He has finished up with a cup of coffee and a liqueur, and after that a glass or two of whisky and soda-water. He has thus afforded every opportunity for this condition to develop, as he has filled his stomach with a mixture of acid wine, saccharine matters, and so much alcohol per cent. as to be incompatible with the normal performance of its digestive functions.

Moreover, the bulk of the liquid that he has taken has been of an effervescing nature, and has evolved plenty of gas, and thus well dilated his stomach to start with. He does not feel much inconvenience until he goes to bed, but then his troubles commence. The stomach, becoming more distended by this continued evolution of gas from its fermenting contents, and being prevented from emptying itself by the spasm of the pylorus, presses up against his diaphragm and displaces his heart slightly upward. Thus the heart's action is impeded and palpitation is produced. The descent of the diaphragm being also

materially interfered with, breathing becomes shallow and difficult. There is a sense of sinking at the epigastrium, and in extreme cases a feeling of impending dissolution. Often the heart is inhibited, and beats slower than it should do, the gastric fibres of the vagus nerve being irritated by the acid contents of the stomach. This state of things usually lasts until about three o'clock in the morning, when the stomach empties itself and the patient goes off to sleep.

Headache, which may exist in various forms, and may vary from merely a slight uneasiness to acute pain. It is generally frontal, but very often occipital. I have seen many cases in which the chief sign of indigestion was an uneasy feeling, hardly amounting to actual pain, which affected the back of the head and extended a little way down the nape of the neck. This invariably came on about an hour after meals, and lasted for two or three altogether.

Sometimes an attack of dyspepsia has evidently acted as the exciting cause for an attack of migraine in patients liable to it.

Vertigo.—The first medical writer to trace a connection between giddiness and dyspepsia was undoubtedly the French physician, Trousseau, who in his classical work ('*Leçons Clinicales*') described it under the name of *vertigo à stomacho laeso*. Whilst it is no doubt a fact that vertigo does frequently occur in dyspepsia, yet I think it extremely probable that many of the cases narrated by Trousseau were really labyrinthine, as Ménière's disease had not been properly made out at the period when he wrote. And it is for this disease, and also for slight epileptic attacks, that we must be on our guard when we meet with a patient suffering, we presume, from vertigo due to stomach disturbance. I can call to mind more than one case where a patient has treated himself for years on account of periodical attacks

of, as he supposed, 'indigestion and biliousness,' and where, on examination, almost complete deafness of one ear has been found. And this mistake is more readily made from the fact that stomach disorder very often acts as the exciting cause of the attack.

The vertigo arising from stomach disorder comes on suddenly, and often only lasts a moment. The patient is usually walking in the street, and suddenly feels giddy and as if he would fall, and catches hold of the railings or his companion. As a rule, the sensation only lasts a few seconds. Sometimes he will feel as if the pavement were heaving under his feet. These attacks may be distinguished from slight seizures of epilepsy by the fact that the face is usually flushed and that they occur shortly after a meal.

They may be differentiated from Menière's disease by the fact that in the latter there is usually—

1. Deafness. Although the patient may be unconscious of this, it may be ascertained by testing the relative hearing distance for a watch with the two ears.

2. The vertigo can be excited by movements, such as coughing and blowing the nose.

3. There is generally some amount of tinnitus.

4. There is imperfect conduction for a tuning-fork from the vertex to one side, and

5. The patient often sees objects distinctly moving in one direction.

Both vertigo due to gastric disease and to Menière's disease may be followed by vomiting.

Feeling of Constriction at the Root of the Nose.—This very distressing sensation, although I believe never before alluded to in any published description of the disease, is of not unfrequent occurrence. It is possibly a vaso-motor disturbance. I have notes of thirteen cases of indigestion in which it constantly occurred, and have observed it in many more. It is a sensation as if

the nose were compressed, and causes frequent involuntary sniffing in the sufferer to try and remove the feeling of obstruction. From my observations I have come to the conclusion that there is absolutely some degree of swelling of the mucous membrane of the nose, and that this condition is almost invariably associated with temporary dilatation of the stomach. It is therefore, apparently, a local vaso-motor disturbance, produced reflexly by irritation of the pneumogastric nerve. It is a sensation extremely like the globus hystericus, only occurring in the nose. Some patients describe it as a sensation that the nose is of immense size; others that the nose is filled with cotton-wool; others as a feeling of constriction at the root of the nose. It is relieved at once by the insufflation of a little menthol or cocaine.

Formication and Tingling.—This may be localized to a finger or toe, or may extend over a whole limb, or even over the greater part of the body.

Numbness.—All of us are familiar with the numbness in a limb caused by continued pressure upon a nerve, such as occurs when we sit with our leg over the rail of a chair. Now, in certain dyspeptic conditions this phenomenon is produced with much greater facility and with much slighter pressure. It is therefore not uncommon to find the region supplied by the ulnar nerves quite numb on waking in the morning, and this has been caused by the mere pressure of the arms on the bed.

There are two abnormal sensations in other parts of the body which I believe are frequently met with in dyspepsia, without being generally ascribed to its influence, viz. :

1. A feeling of heaviness in one foot, or a feeling of constriction round the calf of the leg.

This is undoubtedly dependent upon indigestion, and in the cases where I have observed it, came on suddenly at a variable period after a meal of articles difficult to digest.

2. A sensation as if one side of the mouth were stiff and drawn up.

The patient is usually afraid that paralysis is commencing. This feeling very often comes on immediately after a meal at which a considerable quantity of acid liquid or pepper has been taken. I have seen cases where it could be induced immediately by swallowing a mouthful of highly-seasoned food. When once it has been started, it may persist for hours, days, or even weeks, and cause the greatest distress and apprehension in the patient. In some instances the lips feel swollen, and in others articulation of mimetic words is interfered with. When such is the case the patient, if a medical man, usually fancies that he is about to develop general paralysis of the insane.

It is a curious fact that almost invariably it is the left side which is affected.

The Environment of the Patient.— We must inquire into the condition of the patient as regards fresh air, exercise, personal hygiene, habits of cleanliness, and the condition under which his work is carried on.

Having now learnt as much as we can from interrogation, we can proceed to examine the objective condition.

CHAPTER IV.

THE PHYSICAL EXAMINATION OF THE PATIENT.

Inspection—Palpation—Percussion—Auscultation—Estimation of the Absorptive Power of the Stomach—Of the Motor Power—Of the Solvent Power of the Gastric Juice—Examination of the Stomach Contents—Examination of the Urine—Scheme for the Detection of Proteids by the Saturation Method.

At the present day we are, thanks to recent work, in a far better position than we formerly were to estimate, with an approach to accuracy, abnormalities in the digestive organs and their secretions. As in the examination of the other organs of the body, we make use of the well-known means of inspection, palpation, percussion and auscultation. We have, however, in addition, tests by which we may ascertain the condition of the motor and absorptive functions of the stomach, and we are enabled to apply chemical tests to its contents, and note, not only the composition of the gastric secretion, but also its absolute action upon the food-stuffs with which it comes in contact. We can watch the digestive process from its commencement to its termination, and learn in what respect it differs from normal.

To make an exact and reliable diagnosis, it is necessary to proceed with the physical examination as carefully and in as systematic a manner as we conducted the interrogation of the patient. It is good training to practise one's self in ascertaining as much as possible

from one method of examination before proceeding to the next. We commence with

INSPECTION.

By the simple act of inspection we can learn many points which will help us very much in making a correct diagnosis of the condition of the digestive organs. With the advance of more modern methods, the physician of the present day is apt to neglect the older ones which stood his forefathers in such good stead, and to under-rate the knowledge of the case which he may gain by the simple use of his eyes. The following points should be attended to in order :

The General Aspect of the Patient.—We must note the following: Appearance of urgent illness or not; of languor, of suffering; facial expression; abnormal degree of embonpoint, or marked emaciation; colour and texture of the skin.

We should gain a good deal of information from the general aspect of the patient. In addition to emaciation and the reverse, which will give us valuable hints as to the nutrition of the individual, there are varieties of facial expression which appear to be more or less peculiar to certain affections.

An expression of languor and suffering is common in painful affections of the stomach, such as hypersecretion and ulcer, whilst we are all of us familiar with the facies of cancer.

Marked anæmia of the skin and mucous membranes will afford us strong grounds for suspecting either ulcer of the stomach, or that hyperæsthetic condition of the nerves of the stomach which so frequently simulates it.

The Skin.—The colour of the skin will often give us valuable information. The following are the chief conditions to be looked for :

1. The peculiar tint of chlorosis or anæmia.

2. The cachexia of cancer.
3. The waxy pallor of renal disease.
4. Pigment spots, especially on the fore-arms, pointing to possible absorption of pus.
5. Urticaria, acne, and other eruptions, which may be due to absorption of toxins from retained fæces, or from a dilated stomach.
6. Signs of intemperance in alcohol or food.

The Teeth and Gums.—Observe whether there is :

- (a) Sponginess or chronic inflammation of the gums.
- (b) *Pyorrhœa alveolaris* : Press the gums against the neck of the tooth with a blunt instrument, and observe whether pus exudes. The condition of the teeth as regards tartar should be carefully noted, and whether there is erosion of the gums and alveolar processes exposing the roots of the teeth.
- (c) Defective or carious teeth : Notice particularly whether opposing teeth have been lost in such positions as to interfere with the act of mastication.
- (d) Whether the teeth are habitually kept clean or not.

The Tongue.—Note :

1. Its colour : Normal, pale, or abnormally red.
2. The fur : Position, amount, and colour.
3. Condition of the edges : Indented or smooth.
4. Size : Normal, or broad and flabby.
5. Tremor.

The condition of the tongue is, in my experience, not nearly so trustworthy a means of diagnosing gastric disturbance as is generally supposed.

Apart from the fact that it is very often a purely local matter, being part of the general condition of the mouth (as it is constantly coated in such local troubles as gingivitis, stomatitis, peridontitis, caries of the teeth, and mercurial salivation), we often find the tongue habitually furred in people whose digestive organs are

apparently in excellent order. On the other hand, we not unfrequently meet with clean tongues in patients who have gastric symptoms of considerable intensity.

Dickinson says that it is a common erroneous belief that the tongue is directly indicative of many disturbances of the stomach, bowels, and organs associated with digestion; that some people appear to imagine that the tongue is but an exposed sample of the alimentary canal, and indicates by its changes the extent of similar changes in the hidden parts. With those who do not go thus far, the white tongue is taken as a sign of constipation, or that the stomach and liver are out of order, and that alteratives, especially of the mercurial sort, are needed. He further states that, as the result of many observations, he has not been able to discern any condition of the tongue especially connected with ulcer or dyspepsia. In many of his cases, where dyspepsia was accompanied by stomatitis, the tongue was thickly coated, probably as a local result. In cases of simple dyspepsia and ulcer, the lower degrees of coating were present, possibly in connection with loss of appetite and limitation of food. He also thinks that he has established the fact that while some forms of constipation are undoubtedly accompanied with changes in the tongue, there is no evidence that they stand to one another as cause and effect, as he has seen the tongue perfectly clean and normal after three weeks' total constipation in a hysterical woman.

I think, however, that most observers are of opinion that the tongue *can* furnish in a great majority of cases some useful information, and the following conditions are, I venture to believe, established by experience :

A flabby, pale, moist, relaxed tongue, often indented at the edges, is very frequent in gastric neurasthenia. It is not usually heavily furred.

A tongue red at the tip, furred at the base, bare, scored, or fissured, is often present in chronic gastritis.

A white, or yellowish-white, tongue, especially when slightly tremulous, is very suggestive of chronic alcoholism.

A tongue which is pretty uniformly white over its surface is often met with in atonic or functional dyspepsia.

A yellow or brown fur, mainly up the middle of the tongue, with a bad taste in the mouth, sometimes bitter, sometimes hot, denotes that the liver is functionally deranged.

A large broad tongue, indented at the edges, and covered with a yellowish fur, is met with in acute gastritis.

A tongue with a whitish fur most marked upon the dorsum I have noticed repeatedly in chronic gastritis.

A red tongue, sometimes glazy, is characteristic of chronic gastritis of urinary origin.

The Pharynx.—Note whether congested or inflamed, and whether there are enlarged follicles present.

Catarrh of the pharynx may be associated with gastric troubles as follows :

1. It may be the result of the disorder of digestion. We meet with it under these conditions chiefly among men who either drink or smoke too much. The commonest form is a follicular pharyngitis, which, besides predisposing the individual to catch a severe cold on slight provocation, causes a continual hacking cough. This has been described as a 'stomach cough,' and has not unfrequently been mistaken for commencing phthisis.

2. The catarrh of the pharynx may cause symptoms, such as nausea and loss of appetite, which may be mistaken for stomach trouble, and the patient erroneously treated for such.

The Neck.—Look for enlarged glands. In rare cases we may find secondary infection of the glands of the neck in cases of cancer of the stomach.

The Abdomen.—Inspection of this is valuable, chiefly as affording useful hints with regard to the further investigation of the case.

The patient should be lying on his back, and legs out straight, and breathing gently and naturally.

Under favourable circumstances, that is, when the abdominal walls are not overloaded with adipose tissue, we may often make out :

1. The outline of the anterior lower surface of a distended stomach.—For instance, if in a thin individual with relaxed abdominal walls, we can make out the outline of the greater curvature of the stomach, passing transversely below the umbilicus, we may assume almost for certain that we have to deal with a case of dilatation of the stomach. When the stomach is very much dilated, the appearances are extremely marked. The abdomen is asymmetrical, presenting a rounded swelling in its left half, which stands below the level of the umbilicus, and is bounded inferiorly by a curved margin, which extends from the lower edge of the left ribs to the right of the middle line, and corresponds with the greater curvature of the stomach. In some rare cases the left half of the epigastrium appears to be sunken in above another shorter curved line, which corresponds with the lesser curvature.

In extreme cases the stomach descends much lower in the abdomen than under normal conditions, and the greater curvature may even reach nearly to the pubes. In this condition the epigastric and left hypochondriac regions can be plainly seen to be drawn in and sunken, whilst the lower part of the abdomen is abnormally protuberant.

2. Distended loops of intestine.—In cases of faecal

retention, the loaded viscera can often be seen at the first glance. In dyspeptic conditions associated with fermentative changes in the large intestine, we can very frequently discover a fulness in the right iliac region, pointing to enlargement of the cæcum. I have found this in thirty-eight out of fifty cases of so-called 'intestinal dyspepsia,' which I examined with the special object of ascertaining how often it was present.

3. Abnormal prominence of the abdominal wall.—Note whether this is general or partial.

4. Peristaltic movements of stomach and intestines when in excess.—Whilst protuberance of the abdomen is not in itself proof positive of the existence of dilatation of the stomach (as it occurs also in persons whose small intestines are distended with flatus), yet it is conclusive when we can also see visible peristaltic movements through the abdominal walls.

'If the surface of the abdomen is attentively watched, a wave of contraction may often be seen to start from the left hypochondrium, descend below the umbilicus, and pass on to the right side, and then a little upwards towards the cartilages of the right ribs' (*Fagge*). Or—

'A portion at the extreme left, about the size of the hand, quickly forms a convex prominence, with a decided amount of resistance to pressure; in a few seconds the swelling subsides, and another part, more to the right, swells up for a similar length of time. After each successive portion of the stomach wall has become hard and prominent, the whole subsides. This phenomenon occurs spontaneously, or may be set up by manipulating the abdominal wall, or flicking it with the finger sharply, or sometimes by mere exposure of the abdomen' (*Taylor*).

One must be careful in practice not to confound this phenomenon with hysterical contraction of portions of the abdominal wall, or the contraction of the rectus muscle often caused by manipulation.

5. Depression or retraction of the abdomen.

6. Undue prominence of hypogastrium.—In men above middle age.

The inspection of the abdomen is greatly facilitated by allowing a bright concentrated light to fall upon it, by which means the shadows are accentuated.

PALPATION.

Palpation of the abdomen is a mode of examination of the greatest importance, and should be carefully and deliberately performed. The patient should be placed on his back with the knees slightly drawn up, and maintained in that position by means of a small cushion placed underneath. The arms and legs must be symmetrically disposed, and the head and chest slightly raised by a pillow. There are three things for which we have to examine :

(a) **Sensibility to Pressure.**—In investigating this we have to ascertain the degree of pain produced—whether it is only tenderness or actual pain—and the precise position of the abnormal sensitiveness.

(b) **Abnormal Resistance in the Abdomen.**—The examination should be conducted by placing the flat of the hand upon the abdomen, and pressing very gently towards the vertebral column. Before commencing to exercise pressure, the hand must be allowed to remain in contact with the abdominal wall for a few seconds, in order to avoid inducing contraction in the recti muscles, which if it occurred would entirely vitiate one's results, and absolutely prevent the condition of the internal organs from being ascertained. The abdominal muscles are often naturally very rigid, especially over any deep-seated swelling.

The patient should now draw up his knees, fix both heels well into the surface of the couch, and breathe deeply in and out. The examining hand gently laid

upon the abdomen is then allowed to rise and fall with each respiratory movement, the fingers and palm being kept evenly applied to the skin, and all sudden movements carefully avoided.

Pressure should now be made alternately on both sides of the middle line, and the resistances carefully compared. By this means we may ascertain the presence of tumours or thickenings connected with the abdominal viscera. It is not generally known that it is quite easy to ascertain the presence of fæcal impaction in the ascending and descending colon. To do so it is only necessary to allow the flat of one hand to rest gently upon the surface of the abdomen, below the tenth or eleventh costal cartilage, whilst the fingers of the other hand are passed behind the patient into the posterior hypochondriac region—that is, into the interval between the last rib and the crest of the ilium. The colon can then be pressed upwards and forwards *against* the hand on the abdomen. If the colon is loaded, it will be pressed up against the former, and can be felt as a cylindrical body between the two hands. The secret of the whole thing is that the hand in front must be kept firm and immovable. It is only by this conjoined manipulation that it is possible to detect the slighter degrees of retention in the colon with absolute certainty, as percussion sounds may be so altered or obscured by various concomitant circumstances as to render them valueless. A little practice in this method of manipulation will soon give the requisite dexterity. However, in abnormally fat people, we cannot even by this method arrive at definite conclusions, and must arrive at our own diagnosis by flushing the colon and seeing if any old fæcal matter comes away.

(c) **The Splashing Sound.**—This is elicited by making short, quick, pushing movements with the tips of the fingers over the region of the stomach. You must make out the lowest level at which you can produce it when

the patient is lying, sitting, and standing respectively. When you have done this, make the patient drink a tumbler of water, and repeat the examination, noticing whether the level is different from that obtained in the first observation.

This sound may also be elicited by shaking the patient, when it is known as the 'succussion sound.'

PERCUSSION.

By means of this mode of examination we attempt to determine the size and position of the stomach, and the extent of any new formations which we may have discovered by palpation.

Normal Position of the Stomach.—The greater part of the stomach (about five-sixths) lies to the left of the middle line, and the remainder to the right of it. The lesser curvature and pylorus are covered by the left lobe of the liver, and the fundus lies under the left leaflet of the diaphragm. The pylorus is level with the tip of the ensiform cartilage in the right sternal line.

The greater curvature passes transversely across the abdomen about an inch above the umbilicus. The fundus thus lies partly behind the lower anterior portion of the left lung. It is therefore obvious that in the normal stomach only that portion of its anterior surface which is adjacent to the thoracic or abdominal wall is accessible to percussion. When, however, it is either dilated permanently, or simply abnormally inflated with wind, it is displaced downwards as a whole, and sometimes to such an extent as to enable us to define its upper margin.

In attempting to map out the size of the stomach we should proceed systematically.

The best course to pursue is undoubtedly to try and define first of all the lower limit of the viscus. To do this, one should commence at the symphysis pubis, and

percuss upwards until the characteristic tympanitic sound of the stomach is recognised. This point should then be marked upon the abdomen with an aniline blue pencil.

The note that the stomach gives on percussion may be distinguished from the tympanitic percussion note of the intestines by being deeper in character and not so high-pitched. It is, however, very difficult to describe, and varies very much with the stomach contents.

As regards the method of percussion, mediate percussion is generally employed, and it will be found best to strike as lightly as possible whilst defining the lower margin. On the other hand, we must use considerably more force in order to elicit the characteristic note over the portion of stomach lying beneath the lung.

Besides dilatation of the stomach and atony of its walls, all conditions which press down the diaphragm, such as empyema, pleurisy with effusion, and pneumothorax, will lower the inferior limit of the stomach. The stomach may also be pushed downwards by enlargement of the liver or spleen.

The determination of the upper margin of the stomach is not at all easy to effect, as, unless it is partly filled with air, there is often very little difference to be made out between its percussion sound and that of the margin of the lung.

The exact position of the upper margin of the stomach is as follows :

In the left parasternal line it lies opposite the lower margin of the fifth rib, or the fifth intercostal space ; rarely a little higher or lower.

In the left mammary line, opposite the fifth intercostal space.

In the left anterior axillary line, opposite the lower border of the seventh or eighth ribs ; rarely as high as the lower border of the sixth rib, never lower than the eighth.

In connection with the subject of dyspepsia, the exact fixing of the upper margin of the stomach is of little importance.

The same may be said of the right and left extremities. They are very difficult to make out, and give information of little diagnostic value. In fact, it is only under extremely favourable circumstances that we can define them at all.

It will thus be seen that the apparent dimensions of the stomach, as ascertained by percussion, do not convey any true information, as this percussion area changes its form and magnitude, not only when the stomach itself is altered, but with any alteration in size of the adjacent organs.

For instance, the percussion area of the stomach will be diminished in cases of enlargement of the left lobe of the liver, left pleurisy with effusion, pneumo-thorax, hypertrophy of the heart, or enlargement of the spleen, whilst it will be increased in atrophy of the left lobe of the liver.

But the commonest causes of augmentation of the percussion area are dilatation and displacement downwards of the stomach.

It is a fact to be continually remembered, that as these conditions are apt to occur in conjunction, we may be very easily led to over-estimate the amount of dilatation. In such cases we should always try to make out the positions of both the upper and lower borders of the stomach. If there is really considerable dilatation, we ought to find the distance between them to exceed 10 cm.

Artificial Aids to Percussion of the Stomach.—We have two methods by which we can make the results obtained by percussion of greater value :

1. *Distension of the Stomach with Air or Gas.*—This is a manœuvre of the greatest practical utility, and renders

the results obtained by inspection, palpation, and percussion much more exact. There are two methods of effecting this, viz.: (1) The ingestion separately of powders in solution, which will effervesce and liberate carbonic acid gas when they come in contact with each other in the stomach; (2) the direct insufflation of air through a tube. The first method, although it has been extensively practised in Germany, I shall not describe in detail, as it is a practical failure, and has been superseded by the second. Its disadvantages are that we have no control over the amount of gas produced after the salts have once been introduced into the stomach, and in consequence the distension produced is frequently painful, and occasionally dangerous to life. When air is introduced by means of a tube into the stomach, any excess will readily escape alongside of it as soon as the stomach becomes unpleasantly dilated. Moreover, if at any time pain be experienced, the excess of air can be at once allowed to escape through the tube itself. When using the carbonic acid gas produced from powders, the converse is the case, as the irritation of the gas usually causes reflex closure of the cardiac orifice, and the patient is thus unable to expel it. It is also not at all unfrequent for considerable pain to be produced by the directly irritating action of the carbonic acid gas upon the walls of the stomach.

The method which is now in general use—that of inflating the stomach with air—may be carried out in any one of the following ways:

(a) By direct insufflation from the lungs of the physician. A small stomach-tube, fitted with a glass mouthpiece, having been introduced (see p. 120 for directions for introducing stomach-tubes), the physician takes the latter in his mouth, and blows into it as much air as he thinks necessary. This is both the simplest and, in my opinion, the best method to use. When

sufficient air has been introduced, simple pressure of the rubber stomach-tube will prevent it escaping. This is best done by the patient himself, thus leaving the operator free to manipulate the abdomen by percussion or palpation. When a sufficient examination has been made, the pressure is relaxed, and the air escapes.

(b) With the double ball of an ordinary spray-producer. The tube belonging to this is attached to the glass mouthpiece of the stomach-tube.

(c) Jaworski's method. This has the advantage that, by measuring the quantity of air introduced, it enables the capacity of the stomach to be approximately ascertained. It is of great value in certain cases. The following modification of his apparatus, which I have devised, is so simple that anyone can fit it up for himself. To make it, procure a gallon glass bottle or jar, with a mouth of about an inch and a half or two inches in diameter. Fit this with a good cork pierced with two holes. Through one of these holes pass a piece of glass tubing of sufficient length to pass to the bottom of the bottle. This tube is connected by a rubber pipe to a graduated glass vessel of half a gallon capacity—such as is used for irrigating wounds or giving vaginal douches.* The rubber tube is attached to a tap at the lower part of the vessel.

Through the other hole in the rubber cork passes a glass tube of two inches in length, which is connected by means of a stopcock with the stomach-tube. The graduated glass vessel is now filled with water up to the highest graduation mark, and suspended at some distance above the other bottle. It is obvious that if the stomach-tube be inserted into the patient's stomach, and both stopcocks are opened, the water will flow from the upper vessel into the lower one, forcing out the contained air in the latter, and causing it to pass down the stomach-

* Such a vessel can be procured from any surgical-instrument maker.

tube. The amount of water which passes from the upper vessel to the lower one, as estimated from the graduation marks, will correspond with the quantity of air which passes into the stomach of the patient.

There are certain precautions to be observed in practising insufflation of the stomach. It should never be attempted until the patient has become accustomed to the passage of the tube, and can retain it for some minutes without inconvenience whilst preserving the horizontal position. It is therefore not advisable to try to use this method of examination at the first consultation. It is also of great importance to blow the air in very slowly, and to stop it as soon as a sensation of tension at the epigastrium is experienced. This is necessary that we may not run the risk of artificially inducing a permanent dilatation in a stomach hitherto healthy. The contra-indications for the operation are the same as those attending the introduction of the stomach-tube for other purposes, and are enumerated on p. 120.

2. *Filling the Stomach with Water.*—This may be conveniently done by simply drinking, or by injecting it through a stomach-tube.

These methods are chiefly useful when there is a difficulty in defining the lower margin of the stomach, from the fact that in the case under examination the stomach and transverse colon happen to contain the same substances, and therefore give acoustically the same or very similar sounds. They may both contain air, or both contain solids, or a mixture of air and solids. If, then, we can artificially create a distinguishable difference of sound, our examination will be much facilitated.

For instance, if they both contain air, and we fill the stomach with water, we shall find on percussion a dull sound, easily differentiated from the tympanitic note of the distended colon.

If they both contain solids, we can, by inflating the stomach, in most cases cause a marked difference in the percussion note.

A method which is of great value has recently been introduced for determining the presence of dilatation of the stomach. It depends upon the fact that, if a healthy person drinks one litre of water, the dulness corresponding to the greater curvature is always above the umbilicus. If, however, the viscus is dilated, the dulness will reach to or below it. It is best performed in the following manner: First of all a quarter of a litre of water is given the patient to drink, and then the position of the greater curvature is made out by percussion. This is followed up with successive portions of the same quantity, percussing afresh each time.

This method is extremely valuable, as it gives us a good idea of the tonicity of the muscular walls of the stomach. When there is considerable atony, the stomach will quickly sink down after one or two glasses of water have been taken.

The position of the patient's body during the percussion of the stomach may also render us valuable assistance. If we place the patient in an upright position when his colon contains fluid, this will gravitate downwards into the lower part of the intestine, and we shall be able to make out a zone of clear tympanitic sound between the lower margin of the stomach and the intestine.

Percussion in an upright position is also useful when the stomach is full, as the liquid contents, gravitating downwards, materially assist us in defining its lower margin. When examining in this position, however, we must bear in mind that the tense abdominal walls will always modify the percussion note, and render it duller than it would otherwise be.

In some obscure cases it is of advantage to percuss in

the lateral position, so that the liquid contents of the stomach, falling to the side upon which the patient is lying, will cause parts which were dull in the dorsal position to become tympanitic.

AUSCULTATION.

In auscultating the stomach region, the phenomena which we must listen for are the following :

1. The two distinct sounds which accompany the act of swallowing.
2. Splashing or succussion sounds heard upon some quick movement of the patient, or produced by pushing movements with the ends of the fingers or the end of the stethoscope (see the 'succussion sound,' p. 106).
3. Bubbling sounds.
4. Abnormal conduction of heart or lung sounds over the region of the stomach.

ESTIMATION OF THE ABSORPTIVE POWER OF THE STOMACH.

This depends upon the well-known fact that iodide of potassium when taken into the stomach very quickly appears in the saliva. The patient is given a capsule containing two grains of iodide of potassium. This must be first of all carefully wiped to make sure that none of the drug is adherent to the outside of the capsule. After ten minutes have elapsed, the patient is directed to spit every five minutes into a separate porcelain dish. To each sample a drop of a solution of starch which has been acidulated with a little strong nitric acid is added. The presence of iodide of potassium will be shown by the blue coloration which takes place when free iodine comes into contact with starch. Instead of the porcelain dishes, pieces of starch-paper may be used. In this case a drop of fuming nitric acid must be added. The presence of the iodide should be demonstrable in from eight to fifteen minutes in a normal stomach. If the iodine reaction does not appear in twenty minutes after

the capsule has been taken, it is obvious that the absorptive power of the stomach must be impaired.

The capsules can be prepared extemporaneously by the physician with the well-known Platen's capsules. These are supplied in two parts, which can be put together after the drug has been inserted. Several varieties of ready-filled capsules can be obtained. Personally, I use Oppenheimer's palatinoids.

Another method of estimating the absorptive power is by means of a capsule containing two grains of powdered rhubarb. If the stomach be normal, this should appear in the urine in fifteen minutes, and will strike a red colour with liq. potassæ. This rhubarb test, as will presently be explained, has a decided advantage over the iodide of potassium capsule when it is necessary to use it in conjunction with Günzberg's test (p. 116).

Before using either the iodide or the rhubarb test, it is advisable to be sure that the patient will be ready and able to urinate in a few minutes' time. This precaution will also apply to the salol test to be now described.

ESTIMATION OF THE MOTOR POWER OF THE STOMACH.

To estimate this, advantage is taken of the fact that a drug commonly called salol (a phenol ether of salicylic acid) splits up into phenol and salicylic acid when it comes into contact with an alkali. This decomposition takes place as soon as the drug comes in contact with the alkaline contents of the duodenum.

The interval which elapses between the ingestion of the drug and the finding of salicyluric acid in the urine will give an idea as to the time that the stomach takes to empty itself, and consequently of its motility. A capsule containing fifteen grains of salol is usually given, and the urine examined at intervals of fifteen minutes. Normally, the appearance of salicyluric acid in the urine will take place not later than seventy-five minutes after it has been taken. If it takes longer than this, then

there must be some delay in the passing of the food from the stomach into the duodenum.

It has, however, been found that occasionally, in apparently healthy people, the appearance of the acid may be delayed without obvious cause, and that variations occur from time to time in the same individuals. But as a set-off against this possibility of error, it has been found that invariably the length of time during which the acid continues to be eliminated by the kidneys is much increased in all cases of motor insufficiency of the stomach walls, and that the number of hours beyond the normal during which the reaction can be obtained appears to vary directly with the degree of such insufficiency. We can therefore say positively that if the first appearance of the salicyluric acid be delayed, and if when it has appeared it lasts longer than twenty-seven hours, there must be certainly imperfect peristalsis of the stomach.

The easiest way to test the urine for salicyluric acid is to let a small quantity fall upon a piece of white filter-paper. Upon the centre of this place with a glass rod a drop of a ten per cent. solution of neutral ferric chloride. The edge of the drop of ferric chloride solution will assume a violet colour if the least trace of salicyluric acid be present. These papers may then be dried and preserved for reference.

ESTIMATION OF THE DIGESTIVE OR SOLVENT POWER OF THE GASTRIC JUICE.

This is accomplished by means of what is known as Günzberg's capsule, and must not be confounded with the phloroglucin-vanillin test for free hydrochloric acid, which also bears the same name. Günzberg's capsule consists of a little piece of thin indiarubber tube five-sixteenths of an inch in length, each end of which has been firmly closed with a plug of fibrin. In its interior between the plugs is a grain and a half of

iodide of potassium. The whole is then placed in a thin gelatine capsule. Platen's capsule will do admirably. A test breakfast is given the first thing in the morning, consisting of an egg lightly boiled, four ounces of toast, and a pint of very weak tea without sugar or milk. An hour after this the capsule is swallowed. The subject is then directed to expectorate every fifteen minutes into a porcelain dish or on to starch-paper, as in the test for the absorptive power of the stomach (p. 114), and each sample is tested for the presence of iodide of potassium in the manner there directed. As soon as the fibrin plugs have been dissolved by the gastric juice, the iodide will undergo solution, and will appear in the saliva. If the absorptive power of the stomach and the solvent properties of the gastric juice are both normal, the iodide will appear in the saliva in the average time of 78·5 minutes. This includes the time taken for the solution of the gelatine capsule. If delayed beyond ninety minutes, it may be taken as established that the gastric juice is deficient in solvent properties—that is, if the absorptive power of the stomach is normal. We must therefore ascertain this point first of all, or our test will be valueless. We can do this either by the iodide or by the rhubarb capsule already described. In this case the rhubarb capsule is preferable, because iodide takes such a long time to become eliminated from the system that it has to be given at least forty-eight hours before the Günzberg's capsule. On the contrary, we can give the rhubarb on the same day. It is most conveniently administered in the early morning when the patient wakes. An hour after this the test breakfast may be taken, and again in an hour's time the Günzberg's capsule.

Unfortunately, this test, although so ingenious, only informs us that the stomach contents are able to dissolve fibrin, but tells us nothing absolutely as to the chemical constitution of the gastric juice. It is a fact that under certain conditions of active abnormal fer-

mentation, the stomach contents are able to digest fibrin either entirely or partially in the complete absence of pepsin and hydrochloric acid.

In the majority of cases, however, where other signs render the diagnosis almost certain, in conjunction with the salol and iodide tests, it will tell us all that we require to know, and obviate the necessity of resorting to catheterism. It will also prove invaluable where catheterism is either contra-indicated or the patient will not submit to it.

THE EXAMINATION OF THE CONTENTS OF THE STOMACH.

Although the chemical examination of vomited matters may often afford us information of the highest value, yet in the differential diagnosis of diseases of the digestive organs our most important results are obtained by the examination of the stomach contents at definite times after an experimental meal of known composition. In this chapter the technique only will be dealt with. The clinical significance of the facts observed will be considered in detail in the section devoted to diagnosis.

We shall consider the technique pure and simple under three heads :

1. The test meal.
2. The manipulation of the stomach-tube.
3. The chemical and microscopical examination of the material obtained.

1. The Test Meal.—Apart from the occasions when a stomach which should presumably be empty is explored to see whether it contains anything, it is obvious that, before we can withdraw any gastric juice, we must excite its secretion.

Although the use of electricity and dilute hydrochloric acid have been recommended for that purpose by Ziemssen and Jaworski respectively, in practice we invariably use the normal excitation of food, and give it in what is

known as a test meal—that is to say, a meal of an invariable composition containing representatives of the chief articles of food.

Most specialists in this department have devised a special test meal of their own, and I shall enumerate a few of the best-known of these. It is to be noted that the proper time for using the tube after the meal will vary with its particular composition.

The chief test meals in use are the following:

Riegel's test dinner: This consists of a plate of soup, a small Vienna steak, and a roll of white bread. To put it accurately, 14 oz. of soup, 2 oz. of meat which has been passed through a sausage-machine, and 2 oz. of bread. The stomach contents should not be extracted until five or six hours afterwards.

Klemperer's test breakfast: A pint of milk and 2 oz. of bread. Stomach contents to be examined two hours afterwards.

Ewald and Boaz's test breakfast: $1\frac{1}{2}$ to 3 oz. of bread; 10 to 13 oz. of very weak tea. Stomach contents can be examined an hour after.

Germain See's test meal: 3 to 5 oz. of bread, a small tumbler of water, and 2 to $2\frac{1}{2}$ oz. of minced meat. Stomach contents to be examined from one and a half to two hours afterwards.

Bourget's test meal (*La Médecine Moderne*, August 4, 1892): 300 grs. of toast, and 3 oz. of weak tea without sugar, to which has been added a dram of tincture of mint. This combination has the advantage of containing hardly any albumin to mask the colour reaction of the hydrochloric acid, and is suitable for those cases where the secretion is extremely tardy.

The test breakfast which I invariably use in my own practice consists of 1 lightly-boiled egg, 1 oz. of minced meat, 3 oz. of toast, and quarter of a pint of very weak tea. I prefer this combination, because it approaches more

nearly to the ordinary breakfast of every-day life than any of the others. The contents of the stomach can be examined about an hour and a half afterwards. Both my own and Ewald's test meals contain representatives of albumin sugar, starch, fat, salts, and, extractives. It is more than probable that the tea may act as a condiment, and help to stimulate the secretion of the gastric juice.

2. The Introduction of the Tube.—The stomach-tube in use at the present day is of soft red rubber, with rounded lateral eyes. When it is used for washing out the stomach, it is lengthened by attaching to it, by means of a short length of glass tube, a yard or so of rubber pipe terminating in a funnel. To introduce the stomach-tube, dip it in warm milk or water, and insert it into the open mouth of the patient until it touches the back of the pharynx. At this moment ask him to swallow, and as he does so, pay the tube rapidly in. It will usually slip with great rapidity into the stomach. If the throat be very sensitive, it may be first of all sprayed with a weak solution of cocaine. With some patients you can pass the tube at once without any difficulty; with others there is more trouble, as retching is set up. In these cases, however, a little patience will overcome all difficulty, and after a few attempts the patient will become accustomed to the passage of the tube. For continuous use I prefer a silk gum tube.

Never pass the tube if you can make a diagnosis without doing so, nor when any one of the following conditions are present: Advanced age, pronounced cachexia, pregnancy, menstruation, angina pectoris, valvular disease of the heart, aneurism, advanced phthisis or other severe disease of the respiratory organs, fever, evidence of degeneration or other disease of the arteries, any disturbance of the cerebral circulation, any recent hæmorrhage, whether from stomach, lungs, or cerebral vessels.

The tube having been introduced, there are two methods of extracting the stomach contents—by aspiration, and by expression. The simplest way of using the former method is to take an ordinary large ball enema, squeeze it up in the hand, and insert the nozzle into the end of the stomach-tube. If it is now allowed to expand, it will draw up sufficient of the stomach contents for the purpose required.

But the method most used at the present time is that of expression. It is very simple, and usually efficient. It depends on the fact that anything which will suddenly increase the abdominal tension will force up some of the stomach contents. This can be done either by pressing with the hand upon the abdominal region, or by directing the patient to cough. Usually a few coughs will bring up something through the tube. This manœuvre, however, does not always succeed, especially if the stomach contains a large quantity of fluid. When there is a tendency to hæmorrhage, aspiration should always be preferred.

3. The Examination of the Material obtained.—As I wish this book to be of practical use to the physician in his daily work, I shall not enumerate every test that has ever been devised for the examination of the stomach contents, but shall content myself with describing those which are in most constant use. They will be found amply sufficient.

In order to make an efficient examination of the stomach contents, we shall require the following reagents and apparatus:

Solutions.

Phenol-phthallein: Solution 1 in 500 in proof spirit.

Congo-red: Saturated solution in spirit. It will be convenient to dip some strips of white neutral filter-paper in this, let them dry, and keep for use in a wide-mouthed stoppered bottle.

Boaz's resorcin reagent : This is made by mixing—

Resorcin, 75 grs.
White sugar, 45 grs.
Dilute spirit, $3\frac{1}{2}$ oz.

Phloroglucin-vanillin :

Phloroglucin, 30 grs.
Vanillin, 15 grs.
Absolute alcohol, 1 oz.
Mix.

Neutral ferric chloride : A solution diluted until it is almost colourless.

Neutral ferric chloride : A solution of a straw colour.

Uffelmann's reagent : This is made by adding a few drops of the straw-coloured solution of ferric chloride to $2\frac{1}{2}$ drs. of a 4 per cent. solution of carbolic acid. Water is then added until the resulting mixture is of a pale amethyst colour.

Decinormal solution of caustic soda : This is a $\frac{1}{10}$ th per cent. solution.

Solution of caustic soda : 10 per cent.

Solution of cupric sulphate : 5 per cent.

Lugol's solution : This contains—

Iodine, $1\frac{1}{2}$ grs.
Iodide of potassium, 3 grs.
Distilled water, 3 oz. 3 drs.

Apparatus.

10 c.c. measure.

10 c.c. burette.

Tall narrow glass jar, such as is used in the estimation of cream in milk.

A porcelain evaporating dish and stand.

Spirit-lamp.

Glass funnel with fluted sides.

Large and small glass beakers.

Test-tubes.

Water-bath.

Discs of hard-boiled white of egg.

Let us suppose that you have obtained a sample of the stomach contents of your patient. The first thing to do is to pour it into the tall glass jar and leave it to settle. This will not be complete until several hours have elapsed. You must then note the colour, depth, and other characteristics of the different layers into which it has divided itself. Observe whether there is any froth on the surface, and if so, whether it is tinged with colour. The next thing to do is to fold a filter-paper, and put it into the glass funnel. Stir the stomach contents well up so as to mix all the layers, and pour a portion carefully upon the filter-paper. Notice whether the filtrate runs through quickly or slowly. This is of importance, as you can infer the presence or absence of mucus, which would very materially retard the filtering process. As you will not require much material to work upon, you can commence your experiments as soon as you have obtained a few drams of filtrate. This you can empty out at once into one of the test-tubes or the small beaker, and allow the filtering process to go on. This is necessary, as it must be completed in order that you may be able to make a microscopical examination of the sediment that will remain on the filter-paper.

The next step is to test the filtrate with litmus-paper. We will proceed on the assumption that it is found to have an acid reaction.

We must now estimate the total acidity. This is accomplished by means of the decinormal solution of sodium hydrate, using the phenol-phthallein to indicate when the end of the reaction has been reached. Phenol-phthallein is a substance which remains colourless in acid or neutral solutions, but becomes of a carmine colour in alkaline ones. If, then, to a measured quantity of the fluid you are examining you add a few drops of the phenol-phthallein solution, and then allow, drop by drop, a solution of an alkali to run into it, as soon as

enough alkali has been added to render the liquid the least bit alkaline, the red colour will be developed.

You are then in a position to compare it as regards acidity with the same quantity of a standard acid solution, knowing by previous experiment how much of the alkaline solution would be required to neutralize the latter.

For estimating the total acidity of urine a standard solution of oxalic acid is made use of, but since it is mainly the amount of HCl which we wish to estimate when testing stomach contents, we naturally find it more convenient to express our results in terms of this acid. It has been found that 1 c.c. of decinormal soda solution is equivalent to 0.003646 HCl. Therefore, use 10 c.c. of the filtered stomach contents and multiply by 0.03646, the number of cubic centimetres of soda solution required to neutralize them. The result will be the percentage of HCl in the sample under examination. The soda solution is conveniently added from a burette, and one must shake the beaker containing the filtrate after every successive drop that is added. As the drop of soda solution falls into the liquid, a streak of red colour is developed, which disappears on shaking. The end of the reaction is reached when a faint tinge of colour persists on shaking.

Having determined the total acidity, the next step is to ascertain whether the acidity depends on free acid or acid salts. To do this we either add a few drops of Congo-red solution to a little of the filtrate in a test tube, or dip into it a piece of the filter paper that has been prepared with it. If a free acid be present, the solution will turn sky-blue. Acid salts do not change it. This is a very delicate test, and will react in a fluid containing 0.02 per thousand of free acid. In order to find out if the filtrate contains acid salts as well as free acid, prepare a control solution of HCl of the same strength as

the total acidity of the filtrate as estimated by the phenolphthallein test. Use the same quantity of this and the same number of drops of the Congo-red solution as you did in testing the filtrate. Compare the two colours produced respectively. If the solution of HCl gives a brighter or more intense colour, there are acid salts present in the stomach contents in addition to free acid. To get the best results in employing these tests, accustom yourself to invariably use the same quantities of the fluids, and add them always in the same order. For instance, in the Congo-red test just described the best results are obtained by first putting into the test-tube 5 drops of the Congo-red solution and adding to it 1 c.c. of the filtrate.

Let us assume that the Congo-red gives us the characteristic reaction of a free acid: the next step is to make out which one is present, as other acids besides HCl will give the same results with it. To ascertain the presence of hydrochloric acid, we use Boaz's reagent. Three to five drops of this solution of resorcin are poured out into a porcelain capsule, and an equal quantity of the filtered stomach contents added. It is now heated gently. If HCl be present a beautiful purple-red colour will appear at the edge of the drop. As little as 0.05 per thousand of HCl will give the reaction.

Instead of Boaz's reagent, the presence of free hydrochloric acid may be demonstrated by the phloroglucin-vanillin or Günzberg's test. It is used in a capsule in exactly the same manner as the former. The presence of free hydrochloric acid is indicated by streaks and patches of bright red.

The presence of lactic acid may be ascertained in the following manner: Take two test-tubes and place in each 2 c.c. of the pale neutral ferric chloride solution. To one add 1 c.c. of plain water, and to the other 1 c.c. of the filtered stomach's contents. If lactic acid be

present, the pale liquid will deepen to a distinct canary colour, which can be easily recognised by comparing with the other test-tube, placing a piece of white paper behind to show up the colour. As this test can only be used when the filtered stomach contents are quite devoid of colour, Uffelmann's reagent is preferable for most purposes. The presence of minute quantities of lactic acid will change the blue of this to the canary yellow. The delicacy of this test is such that 2 c.c. of the reagent will give distinct results with 0.8 c.c. of a 0.01 per cent. solution of lactic acid. This is the test in its simplest form, but it is not used quite in this manner in actual practice, for there are other substances frequently found in the stomach which give a reaction which may possibly be mistaken for the one with lactic acid. These are alcohol, sugar, and certain salts, especially phosphates. Moreover, the stomach contents may be of a yellowish colour, and so obscure the reaction. We get over all these difficulties by making an ethereal extract of the stomach contents, evaporating this down, and applying the test to the residue. This sounds very difficult, but it really is extremely easy.

Take 5 c.c. of the stomach contents, and shake up with an equal quantity of ether in a test-tube. When the ether has separated, pour it off into a beaker. Continue this with successive portions of ether until you have used about an ounce altogether. Now stand the beaker in a basin of hot water, and keep it there until the ether has evaporated. To the residue add two or three drops of water, and test as before with Uffelmann's reagent.

Butyric acid, if present in quantities of over 0.5 per thousand, will give with the above test a tawny yellow colour with a reddish tinge.

Acetic acid may be detected by neutralizing the watery residue of the ethereal extract with carbonate of soda, and then adding neutral ferric chloride solution (straw-

colour). A beautiful blood-red colour will appear. This is only produced by one other substance, formic acid, which is never present in the stomach contents.

We now only require to know one other circumstance with reference to the stomach contents—that is, the presence or absence of the digestive ferment. This we easily ascertain by placing a little of the filtrate in a test-tube, adding a few little bits of hard-boiled white of egg, and putting in the water-bath. If neither HCl nor pepsin be present, the albumin will not undergo change. If HCl alone be present, the resulting resolution will give a bluish-violet coloration with the biuret reaction. If pepsin as well as HCl be present, the colour will be purple red.

The biuret reaction is obtained by adding to the filtered stomach contents one drop of the cupric sulphate solution, and then excess of sodium hydrate. For all practical purposes, the observation of the rapidity with which the solution of the albumin is effected will give a sufficient index as to the presence of pepsin or the activity of stomach digestion.

The purple-red colour indicates the presence of albumoses, mixed with peptone. Albumoses, the reader will bear in mind, are a transition stage between albumin and peptone. For all practical purposes it is sufficient to show that albumoses are present, but when greater accuracy is required they can readily be removed, leaving the peptone behind, which will give the true rose-red colour with the biuret test. The albumoses are got rid of by saturating the filtrate with ammonium sulphate. This will throw them all down. The mixture should be allowed to stand for twenty-four hours, and then be filtered. The filtrate will contain peptone free from albumose.

Another and easier method of separating peptone from the mixed products of the digestion of albumin depends

upon the fact, well known to experimental chemists, that peptone is the only proteid which will pass through animal membranes in one hour. Throw some of the filtered stomach contents, or whatever liquid you wish to examine, on a dializer, and at the expiration of an hour let the fluid which has passed through be submitted to the biuret test. If you obtain the characteristic reaction you may be quite sure that it has been caused by peptone, and by nothing else.

Although the preceding gives results accurate enough for most purposes, yet if we wish to learn all we can as to the peptic properties of the filtered stomach contents upon hard-boiled white of egg, we must proceed as follows :

We take four test-tubes, and into each of them we place an equal number of the discs of hard-boiled white of egg. In the first tube we put filtered stomach contents only. In the second tube filtered stomach contents with the addition of a few drops of a 0.2 per cent. solution of hydrochloric acid. In the third tube filtered stomach contents and a few grains of pepsin. In the fourth tube a few grains of pepsin, a little hydrochloric acid, and a little water, but no stomach contents. We now place these four tubes in a water-bath, and keep them at 100° Fahr. for three hours. At the end of that time we test their contents.

If the first one shows the presence of peptone, the gastric juice is probably normal—possibly a little weak.

If the second tube shows distinctly more peptone than the first, then the gastric secretion is deficient in hydrochloric acid.

If the third one shows distinctly better results than the first, then there is deficiency in pepsin.

If both second and third tubes give better results than the first, then the gastric secretion is deficient in both hydrochloric acid and pepsin.

If neither the second nor third tube shows more peptone than the first one, and that indicates that there is a considerable quantity of peptone found, then the gastric juice is probably normal.

The fourth tube is simply for control purposes, to enable us to be sure that the hydrochloric acid and pepsin which we have used in the experiment are of good quality.

In the case where the stomach contents show absence of acid it is as well to go through these tests just the same, and establish negative results for the sake of the practice that it gives.

The substance remaining on the filter-paper should now be carefully examined with the microscope to determine the presence of food residues, and, if found, their nature. In the first place we have to ascertain the relative proportion of animal and vegetable débris. This will give us very important information as to the digestive processes in the stomach. From the amount of action upon the food residues it is often quite possible to fix approximately the length of stay in the stomach by the appearance of these. For instance, you may find a portion of carrot, and the last time the patient ate any was several days before. You are then in a position to say absolutely that the stomach has not completely emptied itself since the date of that meal.

THE EXAMINATION OF THE URINE AND ITS DIAGNOSTIC SIGNIFICANCE.

The points which are useful to us in the diagnosis of disturbance of digestion are :

- The acidity of the urine.
- The volume.
- The amount of chlorides.
- The amount of urea.
- Presence of indican or other chromogens.
- Peptonuria.
- Acetonuria.

The Acidity.—It was first pointed out by Bence Jones in 1819 that fluctuations took place in the reaction of the urine, and that these bore a definite relation to the ingestion of food. After a meal the urine gradually becomes alkaline, and this condition reaches its highest point about three hours after breakfast, and three to five hours after dinner. The cause of this phenomenon is the fact that, with the formation of free acid in the stomach, a corresponding liberation of bases takes place, which pass into the urine and diminish its acidity.

The converse of this is true. That is to say, other things being equal, and there being no other circumstance present which could render the urine alkaline, if no gastric juice is secreted in the stomach the urine must remain abnormally acid. This varying acidity of the urine during the digestive period would be an absolute indication of the amount of the hydrochloric acid of the gastric juice but for two things:

1. The presence of organic acids in the stomach will produce alkalinity of the urine. The acids are converted into carbonates which, passing into the urine, render it alkaline. Thus, the hydrochloric acid might be quite absent from the stomach secretion in a case of chronic gastritis, yet if secondary fermentation had taken place, the urine might be alkaline.

2. The acidity of the urine is increased by a meat diet. We can eliminate this factor by giving a test breakfast consisting of bread and water only.

Notwithstanding these possible fallacies, I think we may safely state that if after such a test breakfast the urine remains acid, there is probably anachlorhydria.

Volume of Urine.—This is diminished in dilatation of the stomach accompanied with excessive vomiting.

The Chlorides in the Urine.—In cases of excessive secretion of HCl in the stomach, the amount of chlorides

in the urine diminishes in a very extraordinary manner. This was first pointed out by Jaworski and Rosenthal, who found considerable diminution in cases of hyperchlorhydria of a neurotic nature. This phenomenon is only what we should naturally expect to find, taking into consideration the mechanism of the secretion of acid in the stomach. The chlorine of the HCl is, we know, derived from the chlorides of the blood, and, consequently, any increase in the former must necessarily be associated with diminution of the latter. This deficiency is much more marked when there is a constant removal of HCl from the stomach as fast as it is formed, such as occurs in persistent vomiting, because in this case the opportunity of reabsorption into the system along the stomachointestinal tract is wanting. For the same reason the amount of chlorides in the urine is diminished when the absorptive power of the stomach and intestines is weakened.

Estimation of Chlorides.—For practical purposes the rough estimation of the amount of chlorides in the urine may be effected with sufficient accuracy by the nitrate of silver test. A solution of nitrate of silver added to urine throws down both phosphates and chlorides. If, however, a few drops of nitric acid be added previously, the phosphates will be held in solution, and only the chlorides fall as a dense opaque white precipitate of chloride of silver. A 1 in 8 solution of nitrate of silver should be used.

When urine contains the normal amount of chlorides— $\frac{1}{2}$ to 1 per cent.—a single drop of the nitrate of silver solution will precipitate the chlorides in cheesy lumps, which are not further divided, or do not make the urine more milky on agitating the glass.

If the chlorides are diminished to $\frac{1}{10}$ per cent. or less, the addition of a single drop of the silver solution no longer produces the white cheesy lumps, but a simple cloudiness, and the entire fluid appears equally milky.

If the chlorides are entirely absent, there will be no precipitate whatever.

The Amount of Nitrogen as estimated by Urea.—If the amount of nitrogen as estimated by urea be *largely increased* in a case of indigestion, we should suspect cancer of the stomach. This fact has been rendered probable by the experiments of Fr. Müller, who found in seven cases of cancer of the stomach that the N secretion exceeded the ingestion, and who explained this fact on the supposition that the body was losing some of its albumin.

The amount of urea is *diminished*—

1. In cases due to gout.
2. Where the food passes through the intestinal canal without being completely digested.
3. Where the absorptive power of the gastro-intestinal tract is much diminished.

Indican and other Chromogens.—The recognition of abnormal amounts of indican in the urine is of considerable importance, as when present in large quantities it implies that abundant albuminous decomposition is actively progressing in some part of the system. It is very often a sign of intestinal putrefaction, and usually varies directly with the activity of that process. Its presence in the urine in excess will often therefore afford us a clue to the significance of certain symptoms of disturbed digestion. Under normal circumstances 5 to 20 milligrammes of indigo-blue can be obtained from the urine passed in twenty-four hours. The method by which it becomes increased in certain cases is as follows:

Whenever a substance named *indol* is introduced into the blood, indican is increased. It has been found experimentally that indol is always produced during the artificial digestion of albumin, in the presence of minced pancreas. It is therefore more than probable that the

indol thus produced during intestinal digestion is absorbed into the system, and converted in the blood into urine-indican. It is now well known that in normal digestion very little indol is produced. On the other hand, the quantity is increased whenever intestinal digestion is delayed or interfered with.

Indican is what is termed a *chromogen*—that is to say, it is a colourless substance which becomes converted by oxidation into a pigment. In the case of indican, the pigment produced is indigo.

The presence of indican may be demonstrated as follows :

First Method.—Add 2 c.c. of fuming hydrochloric acid and a drop of nitric acid to 1 c.c. of urine, and warm. If indican be present, a violet or blue colour will appear. Shake up with a little chloroform. This will absorb the indigo, and sink to the bottom of the test-tube.

Second Method.—Mix 4 c.c. of urine with an equal quantity of strong hydrochloric acid. To this add drop by drop a saturated solution of calcium hypochlorite. Shake. A blue colour will appear, as in the former experiment.

We have in some urines another chromogen which I believe is of importance as indicating faecal retention. It forms a rose-red colour with nitric acid. It is probably a derivative of skatol, and may be identical with pigments previously described under the names of uro-rubin, uro-rosein, etc. I have found it in cases of chlorosis associated with constipation.

Peptonuria.—Peptone in the urine is often found in cases of dilated stomach. The exact mechanism by which this occurs we do not know. Peptone is also present in the urine when there is continual absorption of pus into the system. I have observed it frequently in patients affected with pyorrhœa alveolaris.

To demonstrate its presence, the biuret test may be

applied, as directed on p. 127, after the previous precipitation of all the other proteid constituents of the urine.

Acetonuria is present in certain cases of dilatation of the stomach (see p. 180). It may be identified by the claret colour which the urine strikes with perchloride of iron.

I do not think that I can end this chapter in a better way than by giving a complete scheme for the detection of all the common proteids by what is known as the saturation method. Although such a complete examination of stomach contents will very rarely require to be made, yet everyone who is engaged in treatment of the disorders of digestion ought to know how to conduct such a process when necessary. Having a sufficient quantity of filtered stomach contents, we proceed in the following way :

1. Add an excess of sulphate of magnesium. Precipitate will consist of unaltered globulin.

2. If there has been no precipitate with the above, add a drop of acetic acid. If there is now a precipitate, it will indicate the presence of globulose.

3. Filter off the globulose, and to the filtrate add an equal volume of water. Now add sodium chloride to saturation, and a drop of acetic acid. If there is a precipitate, it will be a mixture of proto- and hetero-albumose.

4. Now add water to throw the solution out of saturation, and the precipitate will disappear. Throw the solution on a dializer, and in twenty-four hours the hetero-albumose will have been reprecipitated, the proto-albumose remaining in solution.

5. Filter off the proto- and hetero-albumose, add an equal quantity of water, and saturate with ammonium sulphate. A precipitate will consist of deuterio-albumose. Filter off. The filtrate will contain all the peptone that

there was in the original solution without any other proteid substance.

Having got as far as this, it will be as well to confirm the presence of peptone in the following manner :

Saturate the original filtrate with ammonium sulphate. This will throw down all the proteids except peptone. Filter off the precipitate, evaporate down, remove the excess of salt as far as possible, then add baryta to remove the remainder. Finally, add dilute sulphuric acid to remove the baryta. Filter. The filtrate will contain peptone only.

Another very useful scheme for the examination of filtered stomach contents is the following :

Boil the filtrate. If coagulation takes place, there is present unaltered albumin or globulin.

Add a trace of caustic potash to another portion. A precipitate will show the presence of acid-albumin.

Saturate a fresh portion with magnesium sulphate. An absence of a precipitate will show that there is no unaltered globulin present.

Add to this a trace of acetic acid. A precipitate will indicate the presence of globulose.

To another portion apply the biuret test. If you get the reaction, you may have both albumose and peptone present. If you have found peptone absent by testing the dializate after one hour, then you have only albumose present.

Into a test-tube put one drop of strong nitric acid. Add to this half an ounce of the filtrate. Set aside for some hours. Albumoses will give the merest opalescence. Add sodium chloride to saturation. A precipitate will be deutero-albumose.

Faintly acidify a fresh portion. Saturate with sodium chloride. If there is a precipitate, it will be a mixture of proto- and hetero-albumose.

Add water to throw the solution out of saturation.

The precipitate will disappear. Dialize for twenty-four hours. The hetero-albumose will be precipitated, the proto-albumose remaining in solution.

Filter off the hetero-albumose, and precipitate the proto-albumose with magnesium sulphate.

Or the combined precipitates of proto- and hetero-albumose may be filtered out, and if a precipitate be now obtained with ammonium sulphate, it can be nothing else than deuterio-albumose.

CHAPTER V.

ETIOLOGY, SYMPTOMS, AND DIFFERENTIAL DIAGNOSIS OF THE CHIEF DISEASES OF THE STOMACH.

Acute Gastritis—Chronic Gastritis—Hyperchlorhydria—Hypersecretion
—Ulcer—Dilatation—Neuroses of the Stomach—Gastric Neurasthenia.

ACUTE GASTRITIS.

Etiology.—The causes of acute catarrh of the stomach are :

1. Irritating substances which have been taken into the stomach and produce inflammation of the mucous membrane by their direct action. These may be :

(a) Chemical poisons such as arsenic and antimony.

(b) Vegetable irritants, fungi, poisonous berries, unripe fruits.

(c) Animal irritants, *i.e.*, decomposing food containing ptomaines, or articles of diet containing an irritant (as mussels).

(d) Excess of ordinary food.

2. Irritants generated in the stomach itself.

These arise from abnormal processes of fermentation in the stomach contents and the consequent development of microbes.

3. Exposure to extreme heat.

Cases have been recorded where workmen have been

seized with vomiting and pain in the stomach after having been exposed to the heat of a furnace.

4. Catarrh of the intestine.

5. Acute diseases, especially of an infectious character, such as cholera, scarlet-fever, erysipelas, measles, diphtheria, smallpox, etc.

Symptoms. — There is generally complete loss of appetite. Sometimes it remains good, but the patient is afraid to eat, knowing that it will cause him subsequent pain. Nausea and retching, and sometimes actual vomiting, are present. The breath is offensive, and there is a pasty taste in the mouth. Thirst is often extreme. There is generally headache, drowsiness, and occasionally vertigo. The patient often experiences a sensation of great prostration and lassitude, with aching in the limbs. Constipation or diarrhœa.

Physical Signs. — Tongue is coated with a thick yellowish fur, although sometimes it is raw and red, and denuded of epithelium.

The breath is offensive, and occasionally there is an herpetic eruption on the lips.

Stomach is usually tender on pressure, and the epigastric region often hard and swollen. This tenderness is diffused over a considerable area, and not limited to a circumscribed spot. Sometimes there is pain at the sternum or in the back. The motor and absorptive functions of the stomach are diminished.

Stomach Contents.—The vomited matters show an absence or diminution of HCl, but are strongly acid from the presence of quantities of lactic and butyric acids. They also usually contain mucus in considerable amount, ferments, and undigested food that has undergone fermentation from remaining too long in the stomach.

Fæces vary both in consistence and quantity, and are very foetid.

Urine diminished in quantity and high-coloured.

Clinical Variations met with in Practice.—1. There is first the simple form of acute dyspepsia due to indiscretion in eating and drinking, so commonly met with in practice. In these cases the patient, after having committed an excess of diet, goes to bed apparently in his usual health, but awakes in the middle of the night feeling faint and sick. He perspires profusely, and vomits the contents of his stomach, with perhaps a little bile. He has perhaps, also, slight diarrhoea. This terminates the attack, and he goes to sleep and awakes in the morning in his usual health. In some cases I have known the attack to occur in the daytime with a fit of syncope, during which the patient vomits and apparently brings up all that he has eaten for the last few days. In this case the fainting is evidently caused by irritation of the pneumogastric nerve, which inhibits the heart's action. It is a curious fact about these cases, that the contents of the stomach come up with very little fluid, no matter how much has been taken with the meal that caused the trouble.

This is really the only form of acute gastritis to which the name of acute indigestion should properly be applied, but in order to facilitate diagnosis the other varieties are here briefly described in addition.

2. Cases due to irritant poisons.

In investigating a case of acute gastritis the possibility of this cause must always be borne in mind.

Among the substances which have been known to cause acute gastritis are strong mineral acids, oxalic acid, caustic alkalies, carbolic acid, phosphorus, arsenic, antimony, and absolute alcohol.

The symptoms will vary with the nature and quantity of the poison taken. Corrosive poisons will usually act upon the lips and mucous membrane of mouth and pharynx as they are being swallowed, and will thus leave a clue to the nature of the case.

Excessive pain in the stomach with vomiting of blood-stained matter will be an early symptom. One can often detect the poisonous material itself in the vomited matters by its smell, and almost always by its chemical reactions. Afterwards follow drowsiness ; small, feeble, and irregular pulse ; collapse, cyanosis, and clammy sweats.

When poisons have a general as well as a local action, their characteristic symptoms will be present.

Death may take place at once from collapse, or later on from the remoter effects of the poison. When corrosive poisons have not an immediately fatal issue, there may result partial atrophy of the mucous membrane of the stomach, or stricture of the œsophagus from cicatricial contraction.

3. There is a clinical variety of acute gastritis occurring in elderly rather than in young patients, usually in the course of some lingering illness, such as chronic Bright's disease. It is often associated with myalgia or bronchitis. It comes on with severe epigastric pain and vomiting. At first only the contents of the stomach are brought up, then a large amount of mucus, and lastly some bile. The other symptoms are thirst and constipation. The tongue is thickly coated, and the temperature slightly raised.

Secondary duodenal dyspepsia occurs as a sequel and necessary concomitant of acute gastric catarrh. The acid undigested contents of the stomach, having reached the duodenum, neutralize the alkaline secretions there. The consequence is, that all duodenal digestion is arrested, the intestinal peristaltic movements are increased, and a kind of diarrhœa is set up, the object of which is to expel the offending material.

The symptoms naturally are abdominal pain, diarrhœa, and mental depression.

The chief diseases with which acute gastric catarrh may be confounded are enteric fever and peritonitis.

From the former it may be distinguished by the absence of rose spots, swelling of the spleen, cæcal pain and gurgling, and the characteristic diarrhœa; from the latter by the circumscribed character of the pain, the more gradual onset, less distension, and, as a rule, absence of collapse.

Course.—In most cases it is not dangerous except when the result of irritant poisons, ptomaines, or when occurring in the course of acute infectious diseases. In young children, on the other hand, it is not unfrequently fatal.

In some cases acute gastritis passes into the chronic form.

CHRONIC GASTRITIS.

Etiology.—This is one of the commonest of the affections of the stomach. It is more frequently met with in men than in women, and belongs especially to adult and old age. As regards its causation, it may be divided into two groups—primary and secondary gastritis.

Primary chronic gastritis is almost always the result of long-continued irritation of the gastric mucous membrane. In most cases the causes have been in operation during the whole life of the patient. When a child he has bolted his food, he has smoked and drank to excess far too early in life, and from the time when he has reached man's estate he has habitually overeaten himself. He has been especially fond of made dishes, and has not stinted himself in the matter of wine and spirits. Since every individual who thus indulges himself does not contract chronic gastritis, it is probable that those who suffer have some hereditary feebleness of the stomach which renders them vulnerable. The symptoms do not begin until long after the causes have become operative. We may therefore assume that the complaint dates much further back than the patient will admit.

In my opinion a badly-kept mouth is a common cause of chronic gastritis. In practice this is often lost sight of, and futile efforts made to cure by drugs and diet an affection which is kept up by the condition of the gums and teeth.

It has already been pointed out that owing to defective teeth the food may be imperfectly masticated, and that such badly prepared material may irritate the coats of the stomach (p. 30). That is *one* of the possible causes of chronic gastritis. I believe that an even more important factor may be found in the circumstance that in badly-cared-for mouths we find spongy, pus-exuding gums, carious teeth containing multitudes of fission fungi, and particles of food between the teeth already undergoing the fermenting process. From the researches of Miller and others we know that in such mouths the butyric and acetic acid producing fungi exist in great abundance. We are also taught that these are not destroyed in the stomach except in the presence of a certain degree of hydrochloric acid, which does not obtain for the first half-hour at least of gastric digestion. Is it therefore improbable that just as a small quantity of yeast will set up fermentation in a whole trough of dough, so these bacilli and particles of fermenting food, swallowed as they necessarily are with every mouthful that we eat, should induce the same processes in the stomach contents? Moreover, they will more easily effect this when chronic gastritis has once become established, as there will then be an even greater deficiency of the protective hydrochloric acid present in the stomach.

Secondary chronic gastritis may be produced in four ways :

1. By the long-continued irritation of the excess of hydrochloric acid in the stomach in cases of permanent hypersecretion.

2. When it follows ulcer or cancer, it may either have

spread by continuity, or be the result of the local irritation produced by these affections and their secretions.

3. It may be caused by any affection which will interfere with the return of blood from the stomach. It is thus commonly met with as the result of venous stasis in diseases of the heart and liver.

4. In certain forms of kidney disease it may be caused by the vicarious elimination of urea by the mucous membrane of the stomach.

Symptoms.—It is often very difficult to determine the length of time during which the patient has suffered, as the commencement of the disease is usually slow and insidious. Moreover, in the early period the affection intermits, and the patient suffers from short attacks of indigestion with intervals of perfect health.

Condition on Rising in the Morning.—Very usually unrefreshed after a night of unpleasant dreams. In some cases nausea and vomiting.

Appetite.—In the early stages not affected; in some cases even exaggerated. Later on it is capricious, and the patient is soon satisfied. It is often perverted. As a rule, sufferers from this complaint eat very poor breakfasts. In the latest stages appetite is absolutely lost.

Taste.—There is often a bad taste in the mouth, especially on first rising in the morning. The sense of taste is often deficient or perverted, and this is more particularly the case if there is a pyorrhœa alveolaris, or pharyngitis, or if the patient's teeth are carious.

Thirst.—During the early period of the complaint there is usually no abnormal thirst. Later it is often excessive between meals, especially in alcoholic cases, and in old men affected with urinary troubles.

Dyspeptic Phenomena.—These consist of weight and fulness in the epigastric region rather than actual pain, flatulence, heart-burn, and certain nervous sensations

which are either reflex or due to the absorption of toxins from the stomach.

These symptoms usually come on two or three hours after meals—that is to say, when the stomach digestion is at its height. Nausea is sometimes present during the digestive period, but is rarely severe. It is otherwise with sufferers from chronic alcoholic gastritis, who often experience a feeling of sickness in the morning, ending in actual vomiting. The vomit in such cases consists of mucus from the stomach, mixed with saliva, and pharyngeal mucus which has been swallowed during the night.

Bowels.—Sooner or later we almost invariably find constipation. In many cases the course of the constipation is interrupted by attacks of diarrhoea. These are due to a temporary subacute catarrh of the intestine, set up by the passage into it of irritating matters from the stomach.

Urine.—Usually scanty, highly coloured, acid, depositing urates and uric acid.

Nervous Symptoms.—These are probably caused in two different ways—by reflex action, and by absorption into the system of toxins from the stomach and intestines. It is impossible in the present state of our knowledge to distinguish between symptoms caused respectively by the one or the other. It is probable, as we have elsewhere pointed out, that symptoms such as drowsiness are caused by auto-intoxication. The chief nervous symptoms associated with chronic gastritis are :

Drowsiness.—This may come on soon after a meal. It will then evidently be reflex, as sufficient time has not elapsed for poisonous products of digestion to have formed. In other patients this symptom appears three or four hours after food.

Vertigo.—Generally occurs when the stomach is empty; rarely after a meal. It is sometimes associated with a

sensation of emptiness in the head, and occasionally with nausea. It hardly ever occurs in patients who are not neurasthenic. This is equally true of the other nervous symptoms which sometimes attend chronic gastritis. In neurasthenics the tendency of this complaint is to produce symptoms referable to the nervous system. Patients who have sound nervous systems usually escape such subjective sensations, and complain of oppression and flatulence.

Dyspnœa.—This is often met with both in chronic gastritis and in gastric neurasthenia. The method of its production has been already described.

Tachycardia.—Palpitation of the heart is a very common symptom, and is met with oftener in women than men. The great bulk of those female patients who come to the out-patient room of a hospital saying that they suffer 'with the heart' have merely palpitations associated with chronic gastritis and dilatation of the stomach.

Hyperæsthesia, Dysæsthesia, and Paræsthesia.—Varying degrees of these are met with in chronic gastritis, but not to such an extent as in gastric neurasthenia.

Physical Signs.—The gums are sometimes normal; sometimes red and spongy. In gastritis which has been caused by pyorrhœa alveolaris there are, of course, the ordinary signs of that affection—the receded gums exposing roots of teeth, the eroded processes, the pus, and the deposit of tartar.

The breath is often offensive; the lips are sometimes cracked and dry.

The tongue is generally coated more or less. This coating is most marked in the morning, and is mechanically removed, to a certain extent, during the course of the day by the attrition of the food. During the periodical exacerbations of his complaint to which the sufferer from chronic gastritis is liable, the tongue becomes more heavily furred.

Saliva is occasionally secreted in excess, and may escape at night from the mouth and wet the pillow. This condition I have only known to occur in heavy smokers.

The pharynx may be the seat of chronic follicular inflammation, attended with the secretion of a thick, tenacious mucus. This leads to hawking, or to a slight hacking cough, worse in the morning.

The whole epigastric region may be swollen, especially after meals. If the patient is not too stout, an abnormal resistance may often be made out. Later on the ordinary signs of dilatation of the stomach will be apparent. There is generally a certain amount of tenderness to deep pressure over this region, but this cannot in any way be compared to the acute pain produced by manipulating a case of ulcer.

Exploration with the Stomach-tube.—We must make two different examinations—when the stomach is empty, and during the digestion of a test meal.

1. *Examination of the Empty Stomach.*—The tube is introduced, and as much of the stomach contents as possible removed by the process of expression. The results which we shall obtain will vary with the stage of the disease.

In the earliest stage we shall probably only be able to obtain from two to three and a half ounces of a viscid, watery fluid, colourless or very slightly tinged with bile.

Its reaction is neutral, alkaline, or faintly acid. It filters very slowly on account of the mucus which it contains. The presence of this can be easily demonstrated by the addition of a few drops of acetic acid, which will give a precipitate of mucin. Upon the filter-paper will remain epithelial cells, free nuclei, micro-organisms, such as sarcinae and yeast, and perhaps some alimentary débris. I might mention that the presence of undigested residues of food, when very small

in amount, does not necessarily point to dilatation of the stomach.

In the second stage the disease will be of longer standing, and of necessity more serious. The quantity of fluid which can be obtained by expression will be much larger, and will contain more mucin. The reaction will usually be alkaline. We shall find a much greater amount of food residues, as in this stage there will be almost certainly dilatation of the stomach.

In the third stage atrophy of the secreting structures of the stomach has taken place. We may find the stomach absolutely empty. This is quite possible if the organ has retained the power of emptying itself. If we obtain fluid, it will contain little or no mucus. If we find that this is entirely absent, it will be a bad sign, as it shows us that there has been an absolute destruction of the secreting tissues of the stomach.

2. *Exploration after a Test Breakfast.*—The test meal which I prefer consists of 1 lightly-boiled egg, 1 oz. of minced meat, 3 oz. of toast, and $\frac{1}{4}$ pint of very weak tea.

In a typical case, examination of the stomach contents two hours afterwards will show—

- (a) Diminution in the quantity of hydrochloric acid.
- (b) Increase in the amount of organic acids.
- (c) Presence of mucus.
- (d) Absence of the reaction of erythrodextrine.
- (e) Undigested fragments of meat.

The amount of total acidity of the filtered stomach contents does not usually serve as an indication of the amount of organic acids present, as these are, to a great extent, combined with the bases of the food.

Diagnosis.—The affection in a typical form presents a disease picture which cannot be mistaken for anything else. It is a slowly progressive indigestion, not particularly painful, the symptoms being chiefly epigastric

fulness, flatulence, and heartburn. There is diminution of the hydrochloric acid secretion, with increase in the amount of organic acids and mucus. In addition there are often alterations for the worse in the absorptive and muscular powers of the stomach. At a later period, when atrophy of the mucous membrane has ensued, the secretion of mucus diminishes or ceases entirely.

The three affections with which chronic gastritis is most likely to be confounded are cancer, ulcer, and gastric neurasthenia. It may also accompany them as a secondary affection. We can only arrive at a diagnosis of primary chronic gastritis by the process of exclusion, eliminating each of these affections successively.

The form of ulcer which is likely to be confounded with chronic gastritis is that which is described later on under the name of *dyspeptic ulcer*. The ordinary typical form, accompanied by severe pain and hæmorrhage, could hardly be mistaken. On the other hand, when pain is slight and hæmatemesis not present, it is possible for a case of ulcer to be erroneously taken to be chronic gastritis. The differential diagnosis can be made at once with great probability by a chemical examination of the contents of the stomach if the ulcer is a recent one. Since we know that it is a general rule in active gastric ulcers to find hydrochloric acid in excess, the presence of such a state of affairs would negative the idea of chronic gastritis, and establish the probability of the former complaint.

It is unfortunately not so easy to make a diagnosis in a case where the ulcer is of long standing, more or less cicatrized, and accompanied by a certain amount of catarrh of the stomach. As a rule, we can make out the fact that there is chronic gastritis, and we can only surmise the fact that there is an ulceration in addition by carefully going into the previous history of the case. If we find that there has been at some previous time

either hæmatemesis or violent gastralgic attacks after food, we are justified in assuming the possibility of an ulcer.

PRIMARY HYPERCHLORHYDRIA.

In this condition the gastric juice is in excess, and contains more pepsin and hydrochloric acid than normal. The secretion, however, preserves the periodicity of health; that is to say, it is produced only during the digestive periods, and ceases in the intervals that elapse between them. It is this which mainly distinguishes it from hypersecretion, in which disease the secretion of gastric fluid is continuous.

Etiology.—It is a very common condition, and will account for nearly one quarter of all the cases of so-called ‘indigestion’ that come under observation. In fact, it is no exaggeration to say that the greater part of all acutely painful dyspepsias depend upon it. Chiefly met with in the young and adult, it has occasionally been observed in old people. In the majority of cases its origin may be traced to a psychological cause, such as grief or worry. It is thus at first obviously a neurosis; in a smaller number, however, it appears to be the result of a prolonged and excessive stimulation of the gastric mucous membrane, as from the abuse of alcoholic drinks, highly spiced dishes, or ices. It is equally met with among the rich, when they eat too fast and do not masticate their food properly, and among the poor, who are compelled, by circumstances over which they have no control, to live on aliments of a coarse and indigestible quality.

Symptoms.—This complaint may commence either suddenly or gradually. In the former case the patient is seized with a sharp pain, and from that moment continues to suffer more or less at his principal meals. In

the latter case, at first merely a sense of uneasiness after food is experienced, but this gradually increases in intensity, until after a longer or shorter time actual pain is present.

The symptoms of a typical well-developed case are the following :

Pain, the most characteristic symptom, comes on two, three, or four hours after meals. In severe cases, there may be an attack every day, and after every meal. Of these, the one after breakfast is the slightest, and the one in the afternoon the most severe. This is a most important point, as it puts in our hands the power of making a differential diagnosis from hypersecretion, by symptoms alone. The difference is that in the latter the most severe paroxysm is at night. Although in hyperchlorhydria in severe cases there may be an attack after every meal, yet in the majority of subjects who consult us, and in whom the disease is not so far advanced, there is only one attack, and that the afternoon one. The duration of an attack varies from a few minutes to some hours, but is usually constant for the same individual. It hardly ever lasts until the next meal, and stops in a short time if food be taken. Mild attacks terminate with the regurgitation of a few mouthfuls of a hot, acid liquid which sets the teeth on edge. In character the pain is severe, lancinating, and constrictive, and is often called cramp by patients. Its position is in the epigastrium and left infra-mammary region, but sometimes is chiefly felt to the right of the middle line in the position of the gall-bladder. In very severe cases it may be so bad as to bend the patient double ; on the other hand, it is often so mild as to be merely felt as a sensation of warmth. One can easily understand the reason why the pain has its time-relation to food. During the first period of digestion the hydrochloric acid is absorbed by, and enters into combination with, the food as fast as it is

produced, and it is only when the latter is satisfied that free acid can be present in the stomach.

Appetite is very good, as we should expect, for not only does the patient digest his food quicker than normal, and thus soon becomes hungry again, but also he has inducement to eat in the knowledge that his pain will be relieved by taking food.

Thirst is increased, and the ingestion of fluid, by diluting the highly-acid stomach contents, relieves the pain almost as much as eating does.

Emaciation is slight or absent, and thus contrasts with the condition of affairs in permanent hypersecretion, where sooner or later it is the rule.

There may be no *anæmia*; that is to say, hyperchlorhydria does not necessarily produce anæmia. It is quite a common thing, however, for chlorotic girls to suffer from a hyperchlorhydria. In fact, my own observations lead me to think it is the general rule. But this is a neurosis, and not the disease hyperchlorhydria; the hyperchlorhydria which may pass if neglected or wrongly treated through the forms of permanent hypersecretion to atony of the secreting structure.

Physical Signs.—The tongue is clean and moist, and never furred as in chronic catarrh and cancer.

There is no flatulence, and this is not surprising, since we should not expect to find any abnormal fermentations. There may be slight tenderness on pressure, especially over the region of the pylorus. There is no dilatation; splashing is absent in the empty stomach, and after a meal cannot be obtained beyond the normal limits, except in long-standing cases, where there is a certain degree of atony.

By the use of the stomach-tube, and by it only, are we able to make an absolute diagnosis. But, then, our diagnosis made by this means is unassailable.

To do this we examine the stomach under three conditions :

1. In the morning before breakfast, when the stomach is empty.

2. Six or seven hours after a meal.

3. Two hours after a test breakfast.

1. If we introduce the stomach-tube before breakfast in a case of hyperacidity, we ought to be able to get up nothing at all. The stomach should virtually be empty. If we do get anything up, it should contain no alimentary débris, no pepsin, and no hydrochloric acid. This will prove to us, first, that there is no abnormal retention of food, and, secondly, that secretion of gastric juice only takes place during the periods of digestion.

We have therefore practically by this one procedure excluded permanent hypersecretion.

2. We introduce the tube some hours after a meal. This will inform us as to the motor condition of the stomach-walls. We shall probably, or at least we ought to, find the stomach empty about the sixth or seventh hour. If this is not the case, there must be a certain degree of atony of the coats of the stomach. This undoubtedly would make the prognosis less favourable.

3. Two hours after a test breakfast, consisting of bread, minced meat, and water, we shall find: (*a*) Excess of free hydrochloric acid to the amount of 3 to 8 per mil. (*b*) The filtrate will dissolve a morsel of fibrine or hard-boiled white of egg with greater rapidity than normal. (*c*) Absence of lactic acid.

Diagnosis.—As the recognition of this morbid condition as a distinct affection of the stomach is of quite recent date, and as the subject has not yet even found a place in most of the text-books of general medicine, I hope my readers will pardon me if I repeat some statements that I have already made. To recapitulate, then, the main points upon which the diagnosis rests are:

1. The relative maintenance of the general health.
2. Pain coming on two or four hours after a meal, and relieved by taking food or a large dose of an alkali. The pain is a real pain, and not to be confounded with the uneasy sensations met with in catarrh, nervous dyspepsia, and most forms of cancer.

The conditions that may be confounded with hyperchlorhydria, and from which it must be distinguished, are permanent hypersecretion, and the stomach troubles accompanying hysteria, neurasthenia, anæmia, and chlorosis and ulcer.

In permanent hypersecretion the pains have the same characteristic intensity and periodicity, but their chief attack is usually in the night, and often terminates by copious vomiting. Moreover, the stomach is usually markedly dilated and the patient emaciated.

In hysteria and neurasthenia the gastralgia is not periodic, and has no time-relation to food.

In anæmia and chlorosis the pain is less severe, and often appears directly after a meal.

In ulcer, the pain is not entirely relieved by alkali, and there is greater tenderness on pressure. But an absolute diagnosis of ulcer cannot be made with certainty unless there be hæmorrhage, and this, moreover, must be tolerably severe, as it is not at all unusual to meet with slight bleeding in hyperchlorhydria. The presence in the stools of altered blood, or the precedence of the late pain by one of almost equal severity coming on shortly after a meal, are each presumptive evidence of the presence of an ulcer.

We are in a position to make our diagnosis absolute without any further waste of time by the use of the stomach-tube. Wash the stomach well out at bedtime, and then the next morning, before anything has been taken, either to eat or drink, pass the tube and examine its contents, if any. If under these circumstances we

find the stomach empty, the case must of necessity be one of hyperchlorhydria; if, on the contrary, we can procure, however small, a quantity of fluid containing HCl, and possessing the power of dissolving albumin, the patient must be suffering from one of the forms of hypersecretion.

HYPERSECRETION.

In this affection there is a continuous flow of gastric juice that does not cease to be secreted during the intervals that elapse between the digestive periods.

Hypersecretion may be either primary, or secondary to some affection of the nervous system, such as tabes. It may also be either intermittent or permanent. The intermittent form is very rare, and has not yet been admitted by all authorities to be a distinct affection.

Etiology.—It is commoner in men than in women, is particularly observed in middle age, and is probably often preceded by an intermittent form of the disease. Its exciting causes are practically the same as those of hyperchlorhydria. It may have a sudden or gradual onset, and, according to V. der Velden, may follow an attack of acute catarrh. In most people, however, it is slow and progressive, and there is usually a period of painful dyspepsia, due, probably, to a simple hyperchlorhydria, before the characteristic gastric attacks and vomitings appear. My own personal experience leads me to think that in the vast majority of instances it begins as a simple hyperchlorhydria, then passes into the stage of intermittent hypersecretion, and finally, if not arrested by treatment, becomes a case of confirmed permanent hypersecretion.

Symptoms.—Although these differ considerably from hyperchlorhydria, and form an *ensemble* which enables a practised observer to form a correct diagnosis from them

alone, yet it is never safe to dispense with the objective examination of the contents of the stomach. By this we can make our diagnosis absolutely certain.

The appetite is usually good, often excessive. There is often more bulimia than polyphagia. The patient feels hungry more frequently than when in a state of health. He often experiences a keen sense of hunger towards the middle of the night, accompanied at first by a sense of sinking, and, if he does not gratify it, by severe pain. Patients feel that they want to eat again a short time after a meal. As in hyperchlorhydria, food rich in albumin will temporarily allay the pain. In cases associated with copious vomiting the appetite is often diminished, but it returns on the disappearance of this symptom.

Thirst is a common, almost constant symptom, and is most marked during the night.

Pain has the same time-relation to meals as in hyperchlorhydria, but has a tendency to become continuous. The attack that occurs in the middle of the night is the worst, lasts for two or three hours, and almost always terminates by vomiting. This nocturnal pain is a common cause of insomnia, and, consequently, the patient often wakes unrefreshed and tired. In these cases, although the stomach always contains a certain amount of hydrochloric acid and pepsin, yet each meal provokes a fresh secretion of gastric juice, containing an excess of HCl, and thus gives rise to pain. The nocturnal pain may be accounted for by the fact that as most of the chyme has already passed into the intestine, there is very little albuminous material in the stomach that can absorb the excess of acid that is constantly being secreted. As a rule, the pain is of greater intensity than in simple hyperchlorhydria, but in exceptional cases may be entirely absent, and the attack may consist of mere discomfort and nausea, followed by vomiting or acid regurgitation.

These cases are difficult to diagnose, and nothing can be said for certain until the contents of the stomach have been examined. As a rule, however, the pain is of extreme severity, and may be felt either in the back, abdomen, lower intercostal spaces, behind the sternum, or in the epigastrium. The last is the position where you meet with pain of the greatest intensity. It is probably then caused by spasmodic closure of the pylorus, set up by the irritation of the acid contents of the stomach. We must bear in mind that, if the stomach be dilated, the position of the pylorus, and consequently of the pain, may be to the right of the mid-line of the abdomen. During the attack of pain, the movements of the stomach may be increased, and there may be either increase or diminution of the quantity of saliva secreted.

Pyrosis is also a symptom, but of very little diagnostic value.

Vomiting is more frequent in hypersecretion than in hyperchlorhydria, and often ends an attack of pain. For this reason many patients induce it by tickling the fauces. It is especially characteristic of the vomiting of hypersecretion, that it terminates an attack of pain, that it consists of a hot, bitter, acid liquid, with or without residues of food, and that it occurs chiefly in the night. It is noteworthy that in hypersecretion some attacks of pain end without vomiting, and some by a few loose stools. In this latter case the stomach gets rid of its excess of acid chyme into the duodenum, and thus increased peristaltic movements of the intestine are set up.

Nocturnal diarrhœa, associated with preceding gastric pain, is thus a valuable diagnostic sign of hypersecretion. Sometimes the stomach empties itself both by cardia and pylorus; then you will have both diarrhœa and vomiting in association. Vomiting is most frequently

met with in cases which have been either badly treated or left to their own devices. Patients of this class often vomit apart from their attacks of pain, and even in the morning, and not unfrequently can keep nothing on their stomachs at all. One of the first effects of appropriate treatment is to diminish the vomiting. The quantity of fluid brought up may vary from half an ounce to two pints. It is usually quite copious, and may be at once distinguished by its character from the simple acid regurgitation of hyperchlorhydria. The characteristics of the vomit will be described later.

Emaciation is one of the most constant accompaniments of hypersecretion, and, in fact, is only absent at the very beginning. It is a curious fact that a patient will often lose weight very rapidly during a temporary aggravation of the complaint. Even when we have by treatment stopped the vomiting and the pain, it is extremely difficult to get the weight up again, chiefly for the reason that the patient never absolutely regains the normal digestive power of the stomach, and is obliged for the rest of his life to restrict himself more or less to a diet from which farinaceous material is excluded. He is thus living on the diet which is adopted by persons who wish to get rid of fat, and it is no wonder if, under the circumstances, he does not put on flesh.

Physical Signs.—*The pulse* is usually small, and very often remarkably slow. It is not unusual to find it as low as fifty a minute. There appears to be an absence of the reflex cardiac and circulatory troubles so frequently met with in other forms of stomach trouble.

The tongue is usually clean, and sometimes abnormally red. On the other hand, I have seen cases in which a yellow fur of the back part of the dorsum was a constant symptom.

The urine is diminished in quantity, as we might expect, from the repeated vomiting, and one of the first

effects of successful treatment is to increase its volume. It is very deficient in chlorides, owing to the large amount of HCl eliminated from the system. During the intervals of comparative health which we get in the early stages of the disease, when the patient is free from attacks, the amount of chlorides may be normal, and may reach 150 to 200 grains a day of twenty-four hours. During an attack the elimination of urinary chlorides falls suddenly, but does not reach its lowest point till two or three days after. It may then be less than 15 grains in twenty-four hours. As a rule, the urine is diminished in volume. Its density is also increased both from this cause and also from an excessive secretion of urea which often occurs. The alkaline tide is also more marked. It begins sooner and lasts longer.

Examination of the Vomit.—In a typical case, accompanied as it nearly always is by a certain amount of gastric retention, the vomited matter will present the following characters: If placed in a tall narrow glass, and allowed to stand, it will separate into three layers.

The upper one consists of froth, and is of a grayish or brownish colour. It is of moderate depth only, but persists for a long time. The middle layer, which occupies the greatest extent, is a turbid, grayish liquid, sometimes with a greenish tinge. The lowest layer is a grayish sediment, which in an unequivocal case consists almost entirely of bread pap, remains of vegetable matters, and fats, such as yolk of egg. This we should naturally expect, as the albuminoids have undergone solution in the excess of HCl and pepsin.

In an early stage of the disease the vomit will filter rapidly, but in a later one the invariable co-existence of gastric catarrh will, from the mucus present, cause the passage of the liquid through the filter-paper to take place more slowly. The filtrate is often quite colourless

and limpid, sometimes slightly tinged with green, or opalescent. The acidity varies from 2 to 4 per mil. If there is very frequent vomiting, the resulting removal of chlorides from the system may cause the acidity of the vomit to fall very low, particularly if the patient be passing through a period when he vomits everything that he takes. The colour reaction will be very well marked in ordinary cases, as a large proportion of the acid contained in the filtrate is in the free state.

The resorcin test will give a wide ring of the characteristic purple-red. As it may happen, if the vomitings are very severe and continuous, that HCl may be for the time completely absent, it will be necessary to make several examinations.

The biuret reaction will be present, showing the presence of peptones, and with Lugol's solution (iodine in iodide of potassium) one can usually obtain the red coloration that indicates the presence of erythrodextrine. That the liquid contains pepsin may be shown by the fact that the filtrate will rapidly dissolve little bits of fibrin or hard-boiled egg when placed over a water-bath.

If the residue that remains on the filter be examined with the microscope, it will be found to consist of vegetable cells, fat globule, nuclei of gastric epithelium, Jaworski's spirals, produced by the action of the HCl on mucus, crystals of fatty acids, and various forms of micro-organisms. These will be bacilli of various forms, sarcinæ, and yeast cells.

Examination of the Stomach by Percussion.—Dilatation is to be observed in most cases; it varies from a very slight enlargement to a severe degree of ectasia. The latter is the rule in severe cases. I believe that most of the severe ectasias of the stomach met with in practice not the result of stenosis of the pylorus are due to permanent hypersecretion. Whilst in recent cases the

lower border of the stomach may not be lower than the umbilicus, in those of long standing it may descend nearly to the pubes. The stomach is also usually displaced, the lesser curvature approaching towards the umbilicus. In addition to this, the pylorus is often pushed down so that it approaches the middle line, the stomach as a whole moving on its cardiac extremity as a centre in such a manner that its long axis tends to become more or less vertical.

This dilatation is the result of several factors. The atony of the muscular walls, exhausted at first by the strain of the repeated acts of vomiting, afterwards altered in texture by the accession of secondary interstitial gastritis; the continual spasm of the pylorus caused by the reflex irritation of the highly-acid stomach contents; and the accumulation of the large quantities of starchy material that the stomach is unable to digest—all combine to produce this result. There is usually slight tenderness on pressure, often limited to the pyloric region, and in addition there is not unfrequently to be made out the tender spot in the lower dorsal region, which has been considered by some writers as characteristic of gastric ulcer when present in conjunction with the former. These two painful pressure spots will be again alluded to when we come to the subject of ulcer of the stomach.

In cases where there is great excess of the HCl , we shall usually find the abdomen retracted and free from flatulence. In other more advanced ones, where the secretion is failing, we may find it tympanitic, and the patient suffering from flatulence during the digestive periods. On deep palpation one can often in old-standing cases make out some slight diffuse indurations, which are evidently the cicatrices of old ulcers.

Exploration of the Stomach with the Stomach-tube.—To make our diagnosis certain we must, as in the case

of hyperchlorhydria, examine the stomach on three separate occasions, but in this disease the times that we choose are different. We must make our examination—(1) In the morning before breakfast, the stomach *not* having been washed out the night before; (2) in the morning before breakfast, there having been a preliminary washing out of the viscus on the preceding night at bed-time; and (3) two hours after a test breakfast.

(1) *Examination of the Empty Stomach without Preliminary Washing.*—Of course, the patient takes nothing to eat or drink, and no medicine, since his late dinner the evening before. This will apply to the next case also.

We may find one of three conditions present; either—

- (a) The stomach is empty;
- (b) We may bring up a considerable quantity of fluid that does not contain any débris of food; or
- (c) There may be food residues, mostly bread and vegetable matter.

The character of the stomach contents will resemble that of the vomit already described. The filtrate will actively digest albumin or fibrin, and exhibit the colour reactions of free HCl. As in the case of the vomit, we shall find on the filter-paper epithelial nuclei, and the corpuscles of Jaworski.

What do we learn from this examination in the different events?

In the first, the fact of the stomach being empty may be accidental, and we must repeat the examination another time. In the second case, where there are no food residues, we know that the stomach is not dilated, or at least that it completely empties itself at the close of a digestive period. In the third we are certain that the opposite is the case, and that there *is* gastric retention. The presence of the corpuscles, according to Jaworski, their discoverer, indicates that there is a true

lesion of the mucous membrane, and enables us to eliminate that form of hypersecretion which is a pure neurosis. We have therefore already acquired a good deal of definite knowledge.

Our next step is to make the—

(2) *Examination of the Stomach Contents, the Stomach having been washed out the Night before.*—(a) If we bring up nothing at all, and if this invariably happens on several examinations undertaken under the same conditions, we must conclude that the stomach does not secrete during the periods of digestive repose, and that the diagnosis is not hypersecretion, but only hyperchlorhydria.

(b) If we bring up any fluid presenting the characteristics of gastric juice—that is to say, that it will digest fibrin, and gives the colour reactions of HCl—it is evident that the stomach *does* secrete during the time that it should be at rest, since we removed the débris of the last meal the night before, and the patient is thus definitely ascertained to be suffering from hypersecretion.

We now proceed to make—

(3) *The Examination after a Test Meal.*—If there is any evidence that gastric retention is present, the stomach must be first emptied, and washed out until the water comes out clear and neutral. This should be done on rising in the morning. The patient then lies down for an hour. Then the test breakfast of bread, meat, and water (2 oz. of finely minced and pounded lean beef, 2 oz. of stale bread, and $\frac{1}{2}$ pint of water) is given.

After two hours the sound is introduced, and the stomach contents evacuated. If we find that there is an excess of total acidity and free HCl, we know that there is hyperchlorhydria in addition to hypersecretion.

On the contrary, if we find that there is less than the normal amount of hydrochloric acid, it is evident that we have to do with one of the rare cases where you get

hypersecretion without any increase in the secretion of acid.

If the quantity of liquid evacuated from the stomach exceeds in volume the amount taken with the test meal, we have proved that there is an excess in amount of the gastric secretion.

The characteristics of the material that we can extract from the stomach are usually the same as in simple hyperchlorhydria — that is, it contains peptones and excess of free HCl, its acid varying from 3 to 6 per mil. When filtered, what remains on the filter-paper consists mostly of undigested bread, the meat being only represented by a few fragments, swollen and gelatinous, and evidently having been strongly attacked by the gastric juice.

Course.—There are four degrees of permanent hypersecretion.

1. The first degree is a simple functional derangement of the secreting apparatus. Secondary gastritis has not yet developed.

Although the gastric secretion is more or less continuous, yet from time to time there are periods of intermission. There is as yet no gastric retention, and not more than 2 to 4 oz. of fluid can be drawn from the stomach that ought to be empty in the early morning. This will, moreover, not contain any food residues. Dilatation of the stomach is slight or absent. There is no emaciation. This shows that nutrition is not yet affected. In this stage treatment gives great relief, and the patient may think that he is cured. Unfortunately, this is too frequently an illusion.

2. In the second degree we get a certain amount of secondary gastritis associated with the functional trouble.

The clinical fact that characterizes this stage is the commencement of gastric retention. In the morning the fasting stomach will contain residues of food, as well

as gastric secretion. The gastric flux is more abundant ; there is almost always dilatation of the stomach, although not very severe, in this stage ; and there is commencing emaciation. In the liquid drawn from the stomach are considerable quantities of epithelial débris, and of the corpuscles of Jaworski.

3. The third degree is unfortunately the stage in which the majority of cases come for the first time to consult us. Here dilatation is more marked, and there is more fluid secreted. One can draw from the stomach in the morning a pint or more of gastric juice mixed with bile and mucus, and containing alimentary residues. As a necessary corollary to the quantity of food got rid of by the stomach, we find that the urine hardly ever exceeds one pint in the twenty-four hours, and is markedly deficient in chlorides. There is gastric retention, and bread and vegetable matters accumulate in the dilated stomach, which may reach nearly as far as the pubes. There is almost always nocturnal vomiting in this stage, and the patients are considerably emaciated and have lost strength.

4. In this class fall the cases of long standing in which the glands, after a long period of over-stimulation, have undergone atrophy, and only secrete the smallest quantity of a fluid very poor in HCl and peptic ferments. The patient vomits less, and suffers less, but he is dying of innutrition. The secretion of gastric juice, although of such poor quality, is nevertheless continuous.

The disease is of very slow progress. It is probable that it begins as simple hyperchlorhydria. The next stage will be that every now and then we shall find periods in which the secretion is permanent. Finally, the secretion is permanent without intermissions.

Prognosis. — We can probably cure the first stage, nearly always the second stage ; often, we can relieve

the third stage and render life tolerable ; but in the fourth we can unfortunately only prolong life for a time by supplying ready-digested foods to the organism.

Diagnosis—The symptoms of permanent hypersecretion are so characteristic that a probable diagnosis can usually be made at once, and exploration with the stomach-tube is only necessary to confirm it. The severe pain coming on some hours after a meal, and especially at night ; the termination of the attack of pain by the vomiting of a highly acid, bitter liquid which contains food residues, especially bread ; the severe thirst, particularly at night ; the exaggeration of the sense of hunger ; the turbid urine ; the gastric dilatation ; the long duration of the malady and the emaciation of the patient, together make up an *ensemble* that cannot be mistaken for any other disorder.

It must be borne in mind, however, that there are cases in which, from the incompleteness of the disease picture, it is quite impossible to arrive at a probable diagnosis without an exhaustive examination of the stomach contents.

The first step in making a diagnosis is, of course, to establish the fact that there *is* hypersecretion. Having ascertained its presence, the next one is to find out whether it is intermittent or permanent. If we cannot deduce this from the symptoms, the stomach-tube, used at intervals of some days, will inform us.

Suppose that it turns out to be intermittent—that is to say, that there are periods of hours or days during which nothing is secreted in the normal intervals between the acts of digestion—we have then to decide whether the affection is primary or secondary. To this end we proceed to examine the nervous system for signs of tabes, hysteria, or neurasthenia. Not finding any of these, we may logically come to the conclusion that we

have to do with a case of primary intermittent hypersecretion—that is to say, the intermittent form of Reichmann's disease.

The affections with which permanent hypersecretion may be confounded, and from which it must be distinguished, are hyperchlorhydria, cancer, ulcer, stricture of the pylorus, gastric catarrh, dilatation, gastralgia, biliary calculus, calculus pyelitis in women, and diabetes.

Hyperchlorhydria.—The differential diagnosis of this affection has been already discussed in the chapter devoted to it.

Cancer.—This affection has certain symptoms in common with hypersecretion, which may cause it to be mistaken for it. Emaciation, loss of strength, cachexia, and even the same characteristic appearance of the face, are often present in both. There are, however, certain points by which the two conditions can be distinguished. We will take them in order.

Pain: Cancer often is accompanied with surprisingly little pain; on the other hand, in hypersecretion the pain is usually of great severity. There is a difference also as regards periodicity. In hypersecretion the pain occurs, almost invariably, after a meal; in cancer there is not nearly so distinct a time-relation to meals.

Vomiting: Contrary to what is usually stated in the text-books, 'coffee-ground vomit' has almost no diagnostic significance. We arrive at much juster conclusions by observing the condition of the food-stuffs in the vomited stomach contents. In cancer you will find the meat and other albuminous substances absolutely untouched, whilst in hypersecretion the solid part of the vomit consists of bread and other vegetable substances, and the meat has been either entirely dissolved, or if there should be any fragments remaining they are swollen and gelatinous, and plainly acted on by the gastric juice.

Appetite: This is almost always absent in cancer, and medicine appears to have very little power to restore it. In hypersecretion the appetite is often normal, and sometimes increased. Although the patient may lose it to a certain extent during the pains and vomitings, yet when these temporarily cease, he soon regains it.

Duration: That of hypersecretion is much longer than that of cancer. When a patient with the former disease comes to consult us for the first time, it not unfrequently happens that the duration of his illness has already exceeded the average length of a cancer case. We can then at once eliminate the latter disease, or at least say that it is extremely probable that it is not present. When a case comes to us that has not been of longer duration than a cancer one, we can usually find evidence that there have been periods in which the patient was apparently in his usual health. It is characteristic of hypersecretion to show periods of amelioration at the beginning; cancer is, on the other hand, generally steadily progressive, and any improvement is either due to medicine or to the favourable influence of a properly regulated diet.

Ulcer.—The diagnosis of this is based chiefly upon the hæmorrhage, and is discussed on pages 174 and 175.

Cicatricial Stenosis of the Pylorus.—This is often extremely difficult to differentiate, as it produces the two most characteristic symptoms of hypersecretion—pain and vomiting. The following rules, however, will help us considerably :

1. If, on palpation of the region of the pylorus, we can discover an induration, the case is probably one of stenosis. The converse of this does not hold good, as a scar may be large enough to contract the pyloric orifice, and yet be too small to be perceived on manipulation.

2. There may be a definite history that makes us infer with almost certainty that we have to do with a case of

stenosis. Such, for example, would be gradual development of the symptoms after an attack some time previously of toxic gastritis from swallowing a corrosive liquid.

3. The presence of any considerable quantity of bile in the vomited matter would naturally negative the idea of stenosis. This sign is not of absolute value.

4. The effect of proper treatment. Hypersecretion will usually be greatly and rapidly improved, and the patient may go days or weeks without vomiting; on the other hand, stenosis will show only slight or transient benefit.

These points will help us to solve the problem that is so often presented to us. That is in any given case that presents the symptoms of hypersecretion, accompanied by evidence of contraction of the pylorus, to determine whether such contraction is spasmodic or cicatricial. This is a question of great moment, as we are at the present day able to deal with the latter affection by surgical means with good prospects of success.

Catarrh of the Stomach.—In this affection the intense pains are absent, and when the vomiting is present what is raised is seen to consist of mucus and food residues, and does not contain any excess of HCl.

Dilatation of the Stomach.—Although hypersecretion is accompanied in most cases by dilatation of the stomach, yet for all practical purposes the latter must be considered quite of secondary importance. It is far otherwise when the disease is in the first instance ectasia depending on atony of the walls of the stomach, or on stricture of the pylorus. The diagnosis may be made by an examination of the contents of the stomach, which will in the latter case present the distinctive character so well known to all my readers.

Gastralgia. — In gastralgia the pain is the only

symptom, and the other signs of hypersecretion are absent.

Biliary Calculus.—An attack of biliary colic may possibly be mistaken for a crisis of hypersecretion, but may be distinguished by taking note that in the latter affection the vomited matters are rich in HCl, and that the stomach is dilated.

Calculous Pyelitis in women is at first sight sometimes confounded with hypersecretion. The turbidity of the urine in the latter affection simulates to the naked eye the presence of pus, and there may be a painful dorsal spot, and vomiting in both affections. The diagnosis is, we need hardly say, instantly made by a chemical examination of the urine and of the contents of the stomach.

Diabetes.—The emaciation, thirst, and hunger of some cases of hypersecretion make us think for an instant of diabetes, but the absence of sugar in the urine will clear us up on that point as soon as we have made the examination.

ULCER OF THE STOMACH.

The study of this disease is most important to us. First, because the presence of ulcer has to be carefully eliminated from all cases of indigestion that come to us for treatment; and, secondly, because there is a form of ulcer characterized by an absence of the cardinal signs, and in which we only find symptoms of slight dyspepsia. These cases are often overlooked and wrongly diagnosed, to the detriment of the unfortunate patient.

Etiology.—Peptic, solitary, simple, or perforating ulcer is usually single, but sometimes multiple. Its form is round, oval, or oblong, its margin being always a curved line, and never irregular. Its long diameter is parallel to the branches of the pyloric and coronary arteries. Its position of predilection is the upper part of the posterior

wall of the stomach near the pylorus, but it may be met with in the duodenum as far as the orifice of the bile duct.

The morbid process is a molecular necrosis, regularly progressive in a radiating direction from a central point. Its causation and relation to hyperchlorhydria and hypersecretion have been discussed on page 40.

It is more frequent in women than in men, but occurs occasionally in children. It is often met with among servant girls and those whose occupations, such as shoe-making, entail pressure on the stomach. Possibly the pressure of the edges of the costal cartilages may in such cases produce anæmia and atrophy of the stomach walls. In women it is often associated with anæmia, chlorosis, and menstrual disorders. In phthisis it sometimes occurs apart from the true tubercular ulcer, and it is not infrequent in cardiac disease.

Symptoms.—We are all of us familiar with the clinical picture presented by a well-marked case of ulcer of the stomach showing the ordinary symptoms. The patient is probably a chlorotic girl. She has been suffering for some time from a painful dyspepsia, which has been thought to be a gastralgia. One day, at the close of a meal, she brings up without effort a considerable quantity of blood. On making a careful examination of her case, we find that she suffers pain shortly after each meal, and she says that she feels it mostly in the epigastrium, and in the back at a point exactly opposite. This pain lasts a long time, and usually terminates by vomiting.

We will consider these symptoms a little more in detail.

Pain.—In some few cases there is no real pain, but the patients experience sensations of epigastric fulness or pressure, in no way to be distinguished from those so commonly occurring in other gastric disorders. The ordinary pain of gastric ulcer has special features with

respect to its time-relation to food, its character, and its localization.

The Time-relation to Food.—It commences suddenly some few minutes after the ingestion of food, and is obviously due to the contact of the substances swallowed with the ulcerated mucous membrane. It may last one, two, or three hours, or even during the whole digestive period. If the patient vomits, it ceases at once. Sometimes the pain will return three or four hours after a meal, but in this case it is due to hyperchlorhydria. The intensity of the pain depends very much on the character of the food taken. As we might expect, albuminous substances that can enter at once into combination with the acid of the gastric juice, such as eggs and milk, will give rise to much less pain than bread and meat. Of course, irritating substances—as alcohol, pickles, and pepper—are especially obnoxious to the tender stomach.

Character of the Pain.—Patients describe it as being burning, gnawing, throbbing, constrictive, and feeling like an open wound. It is rare that it is lancinating.

Localization.—There are two points of predilection for the pain—in the epigastrium, and in the back. In the former the pain occupies the middle third of a line joining the tip of the xiphoid cartilage and the umbilicus. This point corresponds with the position of the pylorus; and it is a fact to be noticed, that in women who lace tightly, and thus lower the position of this end of the stomach, the painful spot is nearer the umbilicus. Occasionally the painful spot is either to the right or to the left of the middle line. The painful spot in the dorsal region lies between the seventh dorsal and the second lumbar vertebræ, and may be over the spinous processes, or on one side of them, usually to the left. It is very limited in extent, its diameter being only an inch and a quarter to an inch and a half. In most cases these two painful spots co-exist.

A very important diagnostic point is that pressure on these regions is very painful, and will often bring on an attack of the characteristic pain. Moreover, pressure on the epigastric point will often bring on pain in the dorsal region. It is important to note that the area which when pressed upon will cause pain is very limited in extent, rarely being larger than a florin piece.

In addition to the characteristic pain, we have *vomiting*, *hæmatemesis*, and *dyspeptic symptoms*.

Vomiting.—There is nothing very characteristic about this symptom. As a rule, the patient has suffered a considerable time from pain, etc., before it appears. It also varies a great deal in degree in different cases. Some patients never vomit at all, but only regurgitate an acid liquid. In some the vomiting only occurs at long intervals, but in others it is very severe. I think that we shall find an explanation of the varied nature of the vomiting in the fact that the ulcer is sometimes accompanied by hyperchlorhydria, and in other cases with hypersecretion. In the former we know that vomiting is not at all common. The vomiting occurring in the course of ulcer differs in no respect from that occurring in the course of hypersecretion, and we have every reason to think that it depends very much on that condition. On the other hand, in some cases we meet with such frequent vomiting, set up by such small quantities of food or drink, that we must assume the existence of an extreme degree of hyperæsthesia of the gastric mucous membrane.

Hæmorrhage.—This has been described as a complication in some text-books. I think that we are justified in regarding it rather as a symptom, for if we take into account small hæmorrhages, it must occur in nearly every case of ulcer of the stomach at some period or other of the disease. For diagnostic purposes, it is a sign of nearly as much value as the pain; although it

may be an early symptom, yet it usually only appears after many months of gastralgic pains.

Dyspeptic Symptoms.—These are practically the same as those of hyperchlorhydria and hypersecretion.

Examination of the contents of the stomach teaches us that there are two varieties of ulcer associated with hyperchlorhydria and hypersecretion respectively. The former occurs mostly in anæmic girls; there is no dilatation or gastric retention, the motility of the stomach-walls is not impaired, and the absorptive power of the stomach is normal. The latter is more serious; the stomach is dilated, there is gastric retention, and the motility and absorptive power are always diminished.

There is a form of ulcer of the stomach which especially concerns us in our study of the various affections which are grouped together under the head of 'Indigestion.' It is the so-called *dyspeptic form* of the disease. Here the cardinal symptoms of ulcer of the stomach are conspicuous by their absence, and consequently mistakes are not unfrequently made in diagnosis. The symptoms exactly resemble those of catarrhal and nervous dyspepsia; and although from time to time there are various painful epigastric sensations, these never approach, either in severity or character, those of ulcer or hyperchlorhydria. It is an unfortunate fact that, although the symptoms are so slight, these patients are just as liable to serious or fatal hæmorrhages as those who are suffering from the more painful varieties of the disease.

The diagnosis can only be made by an examination of the stomach contents. If we find the existence of a hyperchlorhydria, with the presence of small quantities of blood, in a woman who has a certain degree of pain during the digestive period, we shall be justified in making a diagnosis of ulcer. On account of the changes which blood undergoes in the stomach, we shall find the

spectroscope of more service than the microscope in determining the presence of minute quantities.

Diagnosis.—Although, as I have said before, there is no difficulty in making a diagnosis of ulcer when all the classical signs are present, yet it is not so easy when we can find only one or two of them. The following are the principal conditions under which we shall be justified in asserting the probability of the presence of an ulcer.

We may strongly *suspect* the presence of an ulcer if we have—

1. Hyperchlorhydria or hypersecretion, with frequent painful vomitings.

2. Signs of long-standing contraction of the pylorus in a young patient.

3. Occasional attacks of hæmatemesis extending over several years in a patient suffering from dyspeptic troubles.

4. Dypepsia with the epigastric and dorsal painful pressure spots in a young anæmic woman who also suffers from dysmenorrhœa.

We shall be justified in making an absolute diagnosis that we have to do with an ulcer if we find—

1. A considerable hæmorrhage which has been recovered from, followed by the signs of hyperchlorhydria or hypersecretion.

2. Present hæmatemesis associated with painful pressure spots and excess of secretion.

3. Present hæmatemesis associated with excess of secretion without noticeable pain. In this case the hæmorrhage must be more than a mere trace, as in hyperchlorhydria and hypersecretion we often get from the local congestion of the mucous membrane of the stomach small hæmorrhages which are without significance.

DILATATION OF THE STOMACH.

We may really say that this condition was not recognised as of practical importance until some ten years ago. It was regarded as a pathological curiosity. It was not until Reichmann's paper on 'Hypersecretion' in 1882, and Bouchard's analysis of 200 cases of dilatation in 1884, that the subject received any attention to speak of. The reason of this was the fact that the diagnosis of dilatation of the stomach depends almost entirely upon the existence of certain physical signs, and produces no symptoms which are not common to other affections. Dilatation of the stomach, whilst rare in the absolutely healthy, is frequently met with in people who are debilitated from any cause. The apparently healthy individuals who have dilated stomachs are probably not in as good health as they appear to be. In two-thirds of the patients affected it produces no symptom referable to the stomach.

Before proceeding any further, it will be necessary to define what is meant by dilatation of the stomach. Dilatation of the stomach is a condition in which its volume is increased, its tonicity is diminished, and habitual retention of food residues has occurred.

A dilated stomach must be distinguished from an abnormally large stomach, and from an accidentally distended one. In both these conditions the stomach will retract when empty, and regain its normal size. This a dilated stomach cannot do. In like manner simple loss of tonicity is not necessarily at first associated with dilatation, although it invariably becomes so eventually if not cured by proper treatment.

It will be recognised that the study of the symptoms produced by dilatation of the stomach is of extreme importance when we realize that this condition is present

in seven-eighths of all cases of dyspepsia which come under treatment.

Etiology.—Dilatation of the stomach may be essentially produced in two ways : By stenosis of the pylorus or duodenum, and by enfeeblement of the walls of the stomach. We will consider these separately.

Dilatation due to Stenosis of Pylorus or Duodenum.—Stenosis of the pylorus may be caused by congenital malformations, simple hypertrophy, adhesions to neighbouring parts, cicatricial contraction, ulcer or cancer. It is also occasionally due to spasmodic closure of the pylorus. This spasm is frequently met with in hyperchlorhydria and hypersecretion as the reflex result of the highly irritating stomach contents, and is probably one of the main factors in the production of dilatation in hypersecretion.

Obstruction in the duodenum may be either a neoplasm, a cicatricial contraction, or due to a flexion.

It is not necessary for a stricture of the pylorus to be very great to produce dilatation of the stomach. This is probably accounted for by enfeeblement of the muscles of the stomach-wall, in the neighbourhood of the pylorus, and consequent imperfect emptying of it into the duodenum. The stomach being unable to ever absolutely empty itself, dilatation must of necessity take place sooner or later.

Dilatation from Enfeeblement of the Muscular Walls of the Stomach.—This may be due to more or less paralysis of the motor nerves of the stomach, or to weakness of the muscular fibres themselves. The latter condition is most commonly met with.

Dilatation of the stomach, due to weakness of its muscular wall, may occur under the following conditions :

1. In diseases associated with or causing general

debility, such as: Anæmia, chlorosis, syphilis, phthisis, and neurasthenia.

2. Acute illnesses, such as typhoid.

3. Diseases causing circulatory troubles and œdema in the stomach-walls. Affections of heart, liver, and kidneys.

4. Diseases of the spinal cord.

5. As the result of the long-continued use of food improper in quantity or quality.

It is important to bear in mind that certain of these conditions which act as immediate causes of a dilatation may be the result of pre-existing gastric disorders.

Thus, pulmonary consumption and chlorosis are often the direct result of the malnutrition which inevitably accompanies the digestive troubles. Neurasthenia and many other symptoms are caused by the absorption of toxins from the dilated stomach.

Symptoms.—These may be divided into two groups: Those connected directly with the gastro-intestinal tract, and those produced through the mechanism of the nervous system either reflexly or by toxine poisoning.

Symptoms connected with the Gastro-intestinal Tract—

1. Appetite is usually good. There is occasionally polyphagia.

2. Flatulence. This generally occurs two, three, or four hours after food, producing disagreeable distension of the stomach.

3. Eructations. At first these are inodorous. Later on in the digestive period they are musty, finally foetid.

4. Regurgitation. The matters regurgitated often have an acid smell and taste. It is evident that the acidity is due to acetic acid, as hydrochloric acid has no distinctly acid odour.

5. Heaviness and heat at the epigastrium, commencing some little time after meals.

6. Fæces are often soft, doughy, offensive, and acid, and are expelled with pain.

7. In many cases there are symptoms of hepatic congestion.

Symptoms produced reflexly or by Toxine Poisoning.—The following list is condensed from those given by Bouchard, who was the first to study the subject in a scientific manner :

1. Depression in the morning on awakening.
2. Headache, feeling of a painful circle round the head, sensibility to cold, insomnia, vertigo.
3. Obscuration of sight, hemiopia, diplopia, weakness of internal recti muscles, hallucinations of sight.
4. Partial and fleeting dropsy of limbs.
5. Contraction of extremities.
6. Transitory aphasia.
7. Disturbances of vascular innervation, such as
 - Deadness of fingers.
 - Palpitation.
 - Flushing of the face after meals.
 - Pseudo-angina.
 - Nocturnal perspiration limited to head, neck, and thorax.
8. Bilateral intercostal neuralgia.
9. Eczema, pityriasis, pityriasis versicolor, urticaria, acne.

It will be noticed that none of these symptoms are of absolute diagnostic value, as they occur in various groupings in other forms of gastric disturbance and in neurasthenia. This is only what we might expect, since the tendency of modern pathology is to force upon us the conviction that the condition which we term 'neurasthenia' is in many cases an expression of a general toxine invasion.

Physical Signs.—The most important sign of dilatation of the stomach is the production of splashing in its interior

when it ought to be empty. Percussion, palpation, and inspection give us indications of extreme value as additional evidence.

The Splashing Sound.—The method of eliciting this has been described on p. 106. We must ascertain the inferior and the right boundaries of the stomach.

The splashing sound will indicate dilatation when it is heard beyond the normal limits of the stomach—that is, beyond a vertical line through the umbilicus and a horizontal one drawn from the umbilicus to the nearest point of the left costal arch. We may go further than this, as I have already pointed out, and assert that *if the splashing sound can be produced at all* in a stomach presumably empty, with certain reservations to be presently mentioned, there must be dilatation.

Examination with the Stomach-tube.—We may premise by stating that all methods having for their object the measurement of the capacity of the stomach by the introduction of measured quantities of liquid are practical failures.

We may be quite certain that there is gastric retention—

1. If the stomach contains food residues more than seven hours after an ordinary meal.

2. If we can extract anything from it in the morning before breakfast.

This is all that the stomach-tube can tell us for certain as regards the existence of dilatation.

Examination of the Stomach Contents.—As a rule the acidity is increased. This may be due either to an increase in the quantity of hydrochloric acid, or to the abnormal production of organic acids. The former we shall find in the dilatation which complicates hypersecretion; the latter in chronic gastritis. In cases of hypersecretion there will be present débris of undigested bread, vegetables, and starch. In chronic gastritis we

shall expect to see unchanged meat fibres, sarcinæ, and yeasts.

Iodide Test.—This will show in most cases that absorption from the stomach is delayed.

Salol Test.—As we should naturally expect, we shall find that the stomach does not empty itself into the duodenum within the normal time.

Insufflation.—This is a proceeding of great value to confirm the opinion which has been formed. It can, however, only be accomplished upon patients who have had the stomach-tube passed several times, and have become accustomed to the manipulation. By it, in patients who are not too stout, the situation of the greater and lesser curvatures of the stomach can be made apparent to inspection, palpation, and percussion.

Examination of the Urine.—In dilatation of the stomach the urine often shows :

1. Diminution in volume. When present this is an important sign, as it enables us to exclude simple atony of the stomach, in which the urine remains normal in volume.

2. Presence of acetone. In certain cases this substance has been found in the urine in cases of dilatation of the stomach. It is indicated by the red colour which it strikes with perchloride of iron. It is doubtless the result of abnormal fermentation in the stomach and intestines.

3. Peptonuria. This is often met with in cases of dilatation (see p. 133).

Diagnosis.—It is only when present in combination that the physical signs described enable us to form an absolute diagnosis. Singly, they only furnish presumptive evidence. Thus, the splashing sound, heard lower than normal, does not enable us to say positively that dilatation is present without additional methods of examination. To establish the diagnosis of dilatation, we must

demonstrate, first, that the stomach is larger than it should be ; and, secondly, that it is incapable of retracting properly. Dilatation of the stomach may possibly be confounded with several conditions ; these are simple enlargement of the stomach, muscular atony of the stomach, vertical dislocation of the stomach, and gastroptosis. We shall now discuss the signs by which dilatation may be differentiated from them respectively.

An Enlarged Stomach.—The essential point is that when the stomach is simply enlarged, there is no impairment in its muscular power. The stomach will simply hold more than ordinary stomachs, and empties itself perfectly into the duodenum. Six hours after a meal nothing can be brought up by the stomach-tube.

The Muscularly Atonic Stomach.—Here there is no permanent enlargement. When food or liquid is introduced into it, the atony of its muscular walls allows it to dilate and its greater curvature to sink down, and thus the splashing sound can be produced below the umbilicus. This fact can be demonstrated by the method given on p. 113. There is no gastric retention, and the stomach is quite empty seven or eight hours after a meal, and in the morning before breakfast. The urine is normal in volume.

Vertical Displacement of the Stomach.—In this affection the stomach describes an arc of a circle upon its cardiac end as a centre. The pyloric extremity moves downwards and to the left. The long axis of the stomach thus becomes more or less vertical. This condition is very rare in man, and very common in women. It is generally produced by the pressure of the corset. It is one of the prices which women pay for their figure. It may eventually be complicated with total downward displacement. Although in certain subjects the characteristic shape of the abdomen is apparent upon mere inspection, yet an

absolute diagnosis can only be made after insufflation. Its vertical condition can then be readily made out by percussion and palpation.

In young girls a symptom may be sometimes heard which is, I believe, absolutely diagnostic. It is the occurrence of a double gurgling sound synchronous with respiration. It can be heard at some little distance from the patient. I have repeatedly noticed it myself, and it has been described by several observers, notably Strümpell, Clozier, and Chapotôt.

Gastroptosis.—This condition is essentially a lowering of the whole stomach *en bloc*. Whilst it may be produced by anything pushing the stomach down from above, it is usually of abdominal origin, and associated with enteroptosis, the so-called *Maladie de Glénard*. It is then caused by a general relaxation of the abdominal parieties, produced in many cases by tight lacing.

The characteristic diagnostic sign of this affection is depression of the superior border of the stomach. This can only be properly made out by percussion following insufflation.

It is not necessary that there should be any disorder of function; but, of course, there is nothing to prevent a displaced stomach from being the subject of any gastric affection.

CANCER OF THE STOMACH.

Etiology.—It is a question if, of all the organs of the body, the stomach is not the one most frequently the subject of primary cancer. Secondary cancer is very rare. Primary malignant disease is slightly more frequent in men than in women, and occurs chiefly in adult and old age. It is met with oftenest between the ages of fifty and sixty. Heredity has certainly some influence, but this has been greatly over-rated. There are two affections of the stomach—polyadenoma and ulcer—which certainly predispose to it. About six per cent. of

all cases of cancer of the stomach arise from an ulcer either in activity or which has undergone cicatrization.

Symptoms.—*The onset* is slow and insidious in the great majority of cases. Except when it has developed from ulcers, the first symptoms will probably have appeared in a man beyond middle age, who up to the present time has never suffered in any way with his digestion. The symptoms at first are very much like those of chronic gastritis, but the course of the disease is much more rapid. As great a degree of cachexia will be produced by cancer in a few months as chronic gastritis would have taken years to cause. There is nothing especially characteristic about the symptoms at first. Weight at the epigastrium, pyrosis, nausea—these may all be present. Next follows impaired motility of the stomach-walls, with consequent dilatation and retention of alimentary débris. We now have prolongation of the first or lactic acid period of digestion, flatulence, and acid regurgitation. Nausea is a prominent symptom, which occurs not only during the digestive period, but also before breakfast. Anorexia is of constant occurrence, and the sense of taste is altered. There is usually a distaste for tobacco.

When the disease has made considerable progress, there are certain symptoms present which deserve careful and separate study; these are pain, vomiting, hæmatemesis.

Pain.—Although this symptom is a very common one, it is not invariably present. Cases have been known which have reached their fatal determination without anything more severe than slight discomfort. The pain, when present, is not so localized as that of ulcer. It radiates from the epigastrium in many directions, and may be felt in the lumbar and dorsal regions, sides, shoulders, intercostal spaces, and sternum. There does not appear to be any relation between the seat of pain

and the position of the cancer, with the exception that cancer of the lesser curvature is often accompanied by interscapular pain, and growths in the posterior wall of the stomach by pain in the back. The intensity of the pain is not so great as that of ulcer, and, as regards its quality, it has no special characteristics of its own. It is not much aggravated by food, and is not relieved by vomiting.

Vomiting.—In at least half the number of cases, vomiting is caused by cancer of the pylorus. In the others, it is set up either by the irritation of the neoplasm, secondary chronic gastritis, or by some other cause of food retention. Vomiting is an early symptom, but does not, as a rule, occur soon enough to make it of much use in diagnosis. Probably, this will have been already established by other signs. At first it may occur only once or twice a week; later on much more frequently. In certain rare cases where the orifices are not involved, it may never become frequent. The act of vomiting is usually without much effort. There are two kinds of vomiting met with in cases of cancer—in connection with or independently of meals. In the former case it occurs several hours after a meal, and, as a rule, the last food that has been taken is brought up almost completely undigested. If the vomiting only occurs once or twice a week, it is not unusual to find débris of food several days old in the vomited matter. There is usually a quantity of mucus, and the stomach contents have often undergone the butyric or acetic acid fermentation. In the later stages some of the proteid portions of the food will have undergone partial putrefaction, and thus impart a very characteristic fæcal odour to the vomit. We can only say justly that vomiting in cancer occurs independently of meals when it takes place several times a day. Under such conditions we may have a morning vomiting consisting almost entirely of mucus.

A chemical examination of the vomit will show that there usually is an absence of free hydrochloric acid. Combined hydrochloric acid is present only in traces. There may be an increase of lactic acid, and butyric and acetic acids may be present in abundance. An exception to the absence of hydrochloric acid occurs in the early stages of cancer following a recent ulcer.

On a microscopical examination we shall find various kinds of alimentary residues, sarcinæ, yeast, blood, bacilli, and particles of epithelium from the tumour itself.

Hæmatemesis.—Whilst in ulcer of the stomach large hæmorrhages often occur, in cancer they are very rare. The vomit of cancer often contains a little blood, but it is rarely pure. Since a small hæmorrhage does not provoke immediate vomiting, the blood remains long enough in the stomach to become altered by the fluids therein, and to assume the familiar coffee-ground appearance. Whilst it is true that this coffee-ground vomit is common in cases of cancer, yet it has no absolute diagnostic value, as it may occur also in any of the affections of the stomach which are accompanied by hæmorrhage. In doubtful cases the presence of blood may be demonstrated either by the guaiacum test or by means of the spectroscope.

Intestinal Troubles.—At the beginning of cancer of the stomach we often find constipation. Later on, either diarrhœa and constipation alternating, or diarrhœa alone. According to Tripier, diarrhœa exists in more than half the cases of cancer of the stomach, it usually attends the last period of the disease, and it can be present without ulceration of the tumour. It probably depends upon imperfect elaboration of the food in the gastro-intestinal canal.

Melæna is rarely to be demonstrated.

Physical Signs—Cachexia.—Two causes combine to

produce this—the imperfect elaboration of the food in the stomach, and auto-intoxication from the interior of the stomach itself.

Urine.—Quantity, urea, and chlorides are diminished.

Examination of the Stomach Contents with the Tube.—

The description of the chemical examination of the vomit already given will apply here, and nothing further need be said.

Palpation.—A tumour cannot be definitely ascertained to be present until it has attained a certain size, therefore it follows that we must not expect to find one during the first part of the illness. As a matter of fact, tumours are usually made out for the first time after the commencement of the second half of the total duration of the disease.

Diagnosis.—The cardinal symptoms of cancer of the stomach are : Dyspepsia, attended with loss of appetite ; anæmia and cachexia, pain, and a tumour. Neither of these alone is sufficient to establish a diagnosis. A combination of two or more is necessary. There is only one sign which by itself is sufficient to justify the diagnosis of cancer of the stomach. It is the finding, in either the vomit or the fluid drawn off by the tube, of fragments of tissue which can be identified as part of a neoplasm.

Most of the errors of diagnosis will be found to arise from one of the three following causes :

1. Either no symptoms are present, or they are out of all proportion to the gravity of the lesion.
2. The symptoms present are not diagnostic ones.
3. The symptoms which would point to malignant disease are masked by those of an intercurrent affection.

The symptoms which should make us suspect the existence of cancer of the stomach are :

- (a) The progressive increase of the dyspeptic troubles, and of the cachexia.

(b) The progressive loss of weight.

(c) The progressive increase in the size of the tumour if such can be discovered.

There are certain conditions under which mistakes are likely to occur—certain peculiarities in the course of the disease. These deserve consideration. They are :

1. *Malignant Disease associated with Excessive Vomiting.*—This condition is most likely to be confounded with the vomiting of pregnancy.

2. *Malignant Disease with more than usual Pain and Hæmorrhage.*—This may be confounded with ulcer. In ulcer we shall usually find the patient young, and of the female sex, and probably chlorotic. The appetite is normal, sometimes in excess; the taste is not affected, and the tongue is clean. The vomiting usually follows an attack of gastralgia, which disappears as soon as the stomach has been evacuated. The hæmatemesis is more frequent, more copious, and more intermittent than that of cancer. After an attack of hæmatemesis in ulcer the patient will rapidly regain strength. This is not the case in cancer. Here the patient will remain anæmic, and his cachexia will be increased.

3. *Malignant Disease with Early Anæmia.*—When this occurs it is almost impossible to differentiate it from pernicious anæmia in its early stages.

4. *Cancer with Dyspeptic Symptoms only.*—Here we find no pain, no tumour, no vomiting, no hæmatemesis, and no real loss of appetite. The appetite is not quite what it should be, the tongue is foul, there is constipation, and certain uneasy sensations accompany the digestive period. This form of cancer may easily be confounded with chronic gastritis and with gastric neurasthenia.

THE NEUROSES OF THE STOMACH.

We are now beginning to believe that the old idea of a 'nerve exhaustion' as a cause for neurasthenia is in most cases untenable. When we come to look closely into the matter, we are confronted with the fact that if we exhaust a nerve-centre by continuous excitation, the result is that it loses for a time its power of irritability. It cannot discharge energy. It is temporarily exhausted. This is *true* nerve exhaustion. But the symptoms of neurasthenia are not those of exhausted nerve-centres, but of centres which are abnormally irritable. I believe that we shall eventually find that neurasthenia is in nearly every case due to :

1. Intoxication by poisons generated within the system itself, or derived from without, or

2. The inhibition of central controlling power.

We know that such auto-intoxication can be produced by the absorption of the toxins of pus from an alveolar pyorrhœa, or an eroded cervix, or by a sudden stop being put to the elimination from the system of toxins produced within the body. The abnormal irritability of the nerve-centres in neurasthenia is, thus, the irritability of poisoned nerve-centres, not exhausted ones.

The effect of general neurasthenia may be to produce :

1. An isolated neurosis of the stomach.

2. A collection of neuroses, collectively forming the condition proper termed 'nervous dyspepsia,' or with greater accuracy 'gastric neurasthenia.'

Thus an isolated neurosis of the stomach may be a local manifestation of a general neurasthenic condition. Certain of these neuroses are frequently met with in the course of some organic diseases of the spinal cord. Although gastric neurasthenia or nervous dyspepsia may theoretically be considered to be a combination of two or

more of the gastric neuroses, yet it follows generally such a well-defined clinical grouping of symptoms that it will be necessary to consider it separately.

We will now take the chief neuroses of the stomach in succession, and mention their chief characteristics.

In studying the neuroses of the stomach, the following appears to me to be one of the best classifications :

A. Neuroses depending upon a paralytic condition of the motor nerves of the stomach ; this group contains :

Paresis of the muscular tunic of the stomach.

Pyloric insufficiency.

B. Neuroses depending upon hyper-excitability of the motor nerves of the stomach ; to this group belong :

Nervous eructation.

Regurgitation.

Rumination.

Spasm of the cardiac orifice.

Spasm of the pylorus.

Spasm of the stomach.

Peristaltic unrest.

Nervous vomiting.

C. Neuroses of sensation :

Hyperæsthesia of gastric mucous membrane.

Gastralgia.

D. Neuroses of secretion :

Increase of gastric secretion.

Deficiency of gastric secretion.

E. Vaso-motor neuroses.

F. The mixed neuroses :

Gastric neurasthenia or nervous dyspepsia :

A.—Neuroses depending upon Paralysis of Gastric Motor Nerves.

PARESIS OF THE MUSCULAR WALL OF THE STOMACH.
—This condition must be distinguished from atony of the stomach wall. In atony the elasticity and tone of

the stomach muscle is defective. In paresis the contractility is affected. It is an extremely rare affection. It occasionally complicates hysteria, and is sometimes the result of traumatism.

PYLORIC INSUFFICIENCY.—This condition will allow the stomach to empty itself too quickly into the duodenum. The passage of imperfectly elaborated food into this viscus will cause diarrhoea and other dyspeptic symptoms.

B.—Neuroses depending upon Hyper-Excitability of Gastric Motor Nerves.

NERVOUS ERUCTATION.—The eructation which accompanies hysteria and neurasthenia takes place both when the stomach is full and when it is empty, and is not necessarily accompanied by signs of indigestion. It thus differs from the eructation so common in other forms of stomach trouble, which occurs only during the period of active digestion, and is associated with symptoms of disordered function. Nervous eructation has certain well-marked characteristics peculiar to it. The noise is short and explosive, and may be repeated many times a minute. It may be excited by any emotion, and may appear and disappear suddenly. The appetite is good, there are no uneasy sensations after meals, and no emaciation. It appears certain that the gas which is brought up consists of air which has been swallowed immediately before.

REGURGITATION.—This phenomenon occurs chiefly in hysteria and neurasthenia, and is often a prelude to nervous vomiting. The fluid regurgitated may be bitter or acid, or it may be without taste or smell. In the latter case it is sometimes swallowed again. Long-continued regurgitation may pass into the more severe affection—rumination.

RUMINATION.—This is precisely analogous to rumination in animals. Boluses of semi-digested food are brought up into the mouth without nausea or effort, submitted to a second process of mastication, and again swallowed. It is a very rare complaint, and appears to depend upon hysteria.

SPASM OF THE CARDIAC ORIFICE.—The effect of this is to prevent the patient bringing up wind. It often accompanies spasm of the pylorus.

SPASM OF THE PYLORUS.—This is a condition which often accompanies hyperchlorhydria and hypersecretion. It is probably produced reflexly by the irritation of the acid gastric juice. The effect is that the stomach is unable to empty itself into the duodenum, and as it is usually accompanied with a like condition of the cardiac orifice, the patient experiences great distress. The stomach becomes distended with wind, which can be got rid of neither upwards nor downwards.

SPASM OF THE STOMACH.—This affection cannot be diagnosed for certain, but probably accompanies certain nervous vomitings occasionally met with in which there is absolute intolerance of food or drink. The ‘spasms’ of the stomach complained of by elderly ladies in the out-patient room are either attacks of gastralgia, or painful flatulent distensions of the stomach.

PERISTALTIC UNREST OF THE STOMACH.—This is a morbid condition marked by incessant repetition of the peristaltic movements of the stomach. It has been observed in cases of stricture of the pylorus, dilatation, and in permanent hypersecretion. It exists equally as a pure neurosis. It has been met with in locomotor ataxy. It is commonest, as we may imagine, in neurasthenia and hysteria.

NERVOUS VOMITING.—The causes of vomiting have been already enumerated upon p. 82. We may here add a few words with respect to nervous vomiting. We

divide it into two classes—those which are evidently reflex, and those in which a source of irritation cannot be discovered. Vomiting belonging to the latter group is common in hysteria, rare in neurasthenia. It is a peculiarity of neurasthenic and hysterical vomiting that it is rarely accompanied with a feeling of nausea, and the food is brought up without much retching.

C.—Neuroses of Sensation.

Under this heading we may place the different abnormalities of the appetite—bulimia, polyphagia, perversion, nervous anorexia. To these we must add nausea, hyperæsthesia of the gastric mucous membrane, and gastralgia. The last two are the only members of this group which we need discuss here, as the remainder have already been treated in Chapter III.

HYPERÆSTHESIA OF THE GASTRIC MUCOUS MEMBRANE.

—This is either a pure neurosis or is associated with a lesion of the central nervous system. It has been observed in locomotor ataxy and cerebral tumour, and is common in neurasthenia, hysteria, and chlorosis. In the last affection it often leads the physician to make an erroneous diagnosis of ulcer.

Symptoms.—In its mildest form a feeling of weight or fulness is experienced after food, often accompanied with a sinking sensation, nausea, or slight vertigo. In more pronounced cases the stomach is unable to tolerate any food at all, and vomiting occurs directly after a meal. Occasionally this takes place before the meal is finished. It is usual for severe pain to be felt in these severer cases. The appetite is capricious. Patients are often very hungry, but dare not satisfy their hunger for fear of the pain which they anticipate.

Diagnosis.—It is not always easy to make an absolute diagnosis. The chief affections from which it has to be

distinguished are ulcer, chronic gastritis, and gastralgia. At first sight it would appear that ulcer might easily be mistaken for it, since both affections are common in chlorotic girls, and are characterized by pain. Moreover, ulcer is not invariably accompanied by hæmorrhage. But there are differences which should enable us to distinguish between them.

In Ulcer.—The pain is more violent, and is more circumscribed in its area. It depends also very much upon the composition of the meal, which is not the case in gastric hyperæsthesia pure and simple. But the most important point is the chemical examination of the stomach contents. In gastric hyperæsthesia we usually obtain normal gastric juice secreted during the digestive periods only. In ulcer we invariably find hypersecretion, provided that the general health of the patient has not yet undergone marked deterioration.

In Chronic Gastritis.—The disagreeable sensations do not come on so soon after meals. There is generally loss of appetite, and often dilatation of the stomach.

GASTRALGIA.—This is nothing more nor less than a paroxysmal neuralgia of the sensory nerves of the stomach.

Symptoms.—It is usually preceded by nausea, epigastric fulness, salivation, or other prodromata. The seat of pain is in the epigastric and left hypochondriac regions, from which points it may radiate in all directions. The pain is often accompanied by a sense of constriction at the lower part of the chest, also by a sensation of burning and by pyrosis. The pain may vary much in degree. It may be so slight as to cause merely discomfort, or it may be of such extreme severity that the patient is bent almost double, and fears to breathe, cough, or speak. The paroxysm occurs quite independently of food, and shares with hyperchlorhydria and hypersecretion the characteristic that it is relieved by taking it.

Diagnosis.—In making a diagnosis we must bear in mind that there are clinically two varieties of gastralgia, which vary chiefly in severity :

1. A comparatively mild gastralgia, with attacks of short duration. This is usually neurasthenic or hysterical.

2. A much severer form, with longer and more intense attacks. This is usually associated either with tabes or with a primary affection of the stomach.

D.—Neuroses of Secretion.

Until very recently primary hyperchlorhydria and hypersecretion were classed among neuroses of secretion. The chief reasons for excluding them have been given upon p. 39. Most of the affections of the stomach which will be here described are secondary to either an organic disease of the central nervous system or to a general neurasthenic condition. We may divide the neuroses of secretion into two groups: where there is respectively excess, and where there is deficiency of the gastric juice.

EXCESS OF GASTRIC SECRETION.—In this group we shall find the following, and want of space will prevent more than their mere mention :

Hypersecretion of Locomotor Ataxia.—It is probable that the gastric crisis of tabes is not due to the local irritation of an excess of HCl, but is a pure gastralgia.

Neurasthenic Hypersecretion. — This hypersecretion differs from the one already described in being part of a general neurasthenia, and not a local affection. It is, however, possible that the first stage of permanent hypersecretion may be of this nature.

Gastroxyntsis.—This is a condition described and named by Rossbach. It consists of attacks of vomiting which

occur spontaneously, or as the result of over-exertion or emotional disturbances. The material vomited is intensely acid, the reaction being due to the presence of HCl. The affection is probably allied to migraine, and may be defined as paroxysmal attacks of hypersecretion.

DEFICIENCY OF GASTRIC SECRETION.—This is termed hypochlorhydria or anachlorhydria when the hydrochloric acid of the gastric juice is respectively diminished or absent. As we have seen, such a condition may occur in cancer, chronic gastritis, and atrophy of the gastric mucous membrane. But it is also met with as a pure neurosis, especially in cases of neurasthenia and hysteria. It is a fact to be noted that, although HCl may be entirely absent from the gastric secretion, the proenzymes of pepsin and the milk-curdling ferment are not diminished in quantity. When HCl is not entirely absent, but produced in very small quantity, we are unable to demonstrate the presence of free acid in the stomach contents.

Anachlorhydria of nerve origin may possibly be confounded with chronic gastritis, glandular atrophy, and cancer. It may be distinguished as follows :

In *chronic gastritis* we shall probably find a considerable amount of mucus in the stomach contents.

Glandular atrophy is a slow and progressive condition, whilst anachlorhydria of nerve origin commences suddenly, and is accompanied by other symptoms of nerve disorder.

Cancer.—In anachlorhydria of nerve origin there will be an absence of pain, hæmorrhage, and tumour. The gastric contents in cancer often contain an excess of lactic acid, which is not the case in the anachlorhydria under consideration. Indeed, Cohnheim asserts that in the absence of tumour, we can always infer the presence of cancer of the stomach in an early stage, if we find an excess of lactic acid associated with complete absence of hydrochloric acid.

E.—Vaso-motor Neuroses.

Since the circulation of blood in the stomach-walls is under the domination of the vaso-motor nerves, theoretically congestion might take place under their influence.

Inflammation of the stomach has been described as accompanying certain lesions of the brain. It is probable that troubles of the vaso-motor innervation of the stomach play some part or other in the pathology of diseases of the stomach. But at present the only example which we know of is the vicarious hæmorrhage of menstruation.

F.—The Mixed Neuroses, Gastric Neurasthenia, or Nervous Indigestion.

Having now passed briefly in review the various neuroses of the stomach separately, we shall proceed to discuss the way in which they are usually associated to form the very well-known and common '*nervous or atonic*' indigestion. Gastric neurasthenia is a better name, as it is essentially a neurasthenic condition of the stomach.

Gastric neurasthenia may be defined as an affection of the stomach of nerve origin, accompanied by an indigestion resembling very much the flatulent dyspepsia of chronic gastritis. It is evidently due to abnormality of function in the nerves which preside over the stomach and intestines. More than two-thirds of all the cases of this complaint met with in practice are part of a general neurasthenia.

We may distinguish clinically two forms of gastric neurasthenia—a mild and a severe one. These differ chiefly in the fact that in the less severe form of the disease the patient keeps his weight, whilst in the other

one he emaciates. They are sufficiently distinct in their essential characters to merit separate descriptions.

THE MILD FORM OF GASTRIC NEURASTHENIA.—The patient manages to digest enough food to keep himself in health, notwithstanding that he possibly suffers pretty severely during the digestive period.

Symptoms.—*Appetite* variable.

Tongue.—Moist and clean, sometimes slightly coated at the back and sides; often flabby, with indented edges.

Pain.—There is often discomfort, or even actual pain, directly the food has been swallowed. The gastric nerves are hypersensitive, and feel painfully the impression of food, which normally should produce no sensation. The kind of food appears neither to influence the character of the discomfort nor the time when it makes its appearance. It has often been observed that articles of food which will not agree one day will be perfectly tolerated on the next. In a certain number of cases the pain or discomfort comes on some time after food. Here it is probably due to a hyperchlorhydria of purely nerve origin. Very often the pain does not come on until the stomach is nearly empty, and is relieved by taking food. Many patients feel at their best for a short time after a meal. Most neurasthenics do not feel equal to anything until after lunch. The pain is sometimes a true gastralgia, more often a sensation of weight or swelling in the hypochondriac or epigastric regions.

Flatulence.—The stomach usually contains a good deal of wind, but there is no real dilatation. The atonic muscular wall of the stomach not only allows the accumulation of gas, but also gives a little under the weight of the contained food, and sinks towards the umbilicus.

The splashing sound can therefore usually be obtained during the greater part of the digestive period. Towards

the middle of digestion the patient usually commences to bring up wind, each eructation giving a little temporary relief. This gas is air which has been swallowed, and not the result of fermentation.

Nervous and Vaso-motor Symptoms.—Neurasthenics often suffer during digestion from flushes of heat, drowsiness, lassitude, inability for mental work, palpitation of the heart, and occasionally throbbing in the head. These symptoms are either reflex or are due to the absorption of toxins formed during digestion. After digestion has been completed, the patient may still suffer from certain uneasy sensations, such as sinking, dragging, hunger, uneasy sensations in the head, and slight vertigo. In a great many cases of gastric neurasthenia the whole affection may be summed up in the fact that the patient is conscious that he has a stomach.

Physical Signs.—There are usually painful pressure spots somewhere between the umbilicus and xyphoid cartilage. As a rule, motility is impaired, and there is diminution of hydrochloric acid in the gastric juice. In a few cases there is hypersecretion.

THE SEVERE FORM OF GASTRIC NEURASTHENIA.

Symptoms.—Here we find practically the same symptoms as in the milder form, but more pronounced. There is greater pain, more frequent eructation, and constipation of a more troublesome character. In addition we have the progressive emaciation of the patient. In this complaint we have combined a severe neurosis of motility of the stomach, associated with deficient acidity and deficient absorption both from stomach and intestine. In one case recently under my care the free acid of the gastric juice was only 0.2 per 1,000 two and a half hours after a meal. The reaction with the salol test was 200 minutes; with the iodide capsule, 30 minutes; and with Günzberg's capsule, 135 minutes.

It is probable that in most cases the nerves which

preside over the functions of the intestine, pancreas, and liver are gravely affected. Thus, the fats and starches of our food are not acted upon, and constipation is pronounced. In cases of long duration real lesions of the digestive organs are produced. First comes dilatation of the stomach; following this, abnormal gastric fermentations and chronic gastritis. In this grave form of gastric neurasthenia there is a great tendency for a vicious circle of disease to be set up. The imperfect elaboration and absorption of the food, the result of gastric neurasthenia, further impoverishes the nervous system, and thus perpetuates, even if it does not increase, the neurosis.

Diagnosis.—Although this affection appears to simulate most of the other diseases associated with derangements of digestion, yet there are points which will help us materially in arriving at a diagnosis.

1. The subjective symptoms, and in the grave form the defect of nutrition, are out of all proportion to the departure from normal of the organs of digestion and their secretions as determined by a physical examination.

2. Some of the usual signs of neurasthenia are sure to be present. These are enumerated on pp. 91 and 178.

3. In the milder form the quantity and quality of the food do not have any effect upon the symptoms.

4. The severity of the complaint varies from day to day directly as the general state of health of the patient.

Nervous indigestion, or gastric neurasthenia, is most likely to be confounded with cancer, chronic gastritis, or ulcer of the stomach.

Cancer.—During the first stage of cancer, that is to say, during the first four or five months, the only symptoms present may be digestive troubles exactly resembling those of gastric neurasthenia. The distinctive signs, pain, tumour, and hæmatemesis, are absent. The examination of the contents of the stomach will help us

a great deal, since although there is hyperchlorhydria in both affections, yet the prolongation of the lactic acid period of digestion spoken of by Cohnheim as a diagnostic sign is of great value and probably owes its existence to the diminution of hydrochloric acid in the stomach. There are, however, several other points which will help us in diagnosis :

1. Nervous indigestion usually attacks a person who is already a neurasthenic. Cancer almost invariably appears in a person of middle age who has been up to that time in robust health.

2. Most cases of gastric neurasthenia which come under treatment have already passed the time limit of cancer. The duration of malignant disease rarely exceeds eighteen months.

3. Cancer is continuously progressive. Gastric neurasthenia has periods of intermission in which the patient may be entirely free from his dyspeptic symptoms.

4. Anæmia is more marked in cancerous cases. In gastric neurasthenia patients preserve their colour a remarkably long time, notwithstanding their loss of weight.

5. Vomiting is rare in gastric neurasthenia ; common in cancer.

Chronic Gastritis.—This affection has certain symptoms of its own which are not as a rule present in gastric neurasthenia. Vomiting is more common. The vomit is composed of mucus and alimentary débris. There is much more mucus than there should be in the stomach contents even two hours after a test meal. Grave forms of advanced chronic gastritis are characterized by the absence of digestive ferments from the gastric juice. This is especially the case as regards the milk-splitting ferment. On the other hand, in gastric neurasthenia it is the hydrochloric acid of the gastric juice which is in defect. The ferments themselves are present, but in the

form of inert proenzymes which require the presence of HCl to become functionally active. Loss of appetite is more frequent in chronic gastritis. The beneficial effect of regulation of the diet, lavage and abstention from alcohol, is much more marked in cases of chronic gastritis than in gastric neurasthenia.

Ulcer.—It is possible that gastric neurasthenia may be confounded with certain cases of ulcer not attended by hæmatemesis or severe pain. Under these circumstances the tender pressure spots, already alluded to as sometimes present, may be taken for those of ulcer.

This is hardly likely, however, to trouble us much in actual practice, as the tender points in question are not nearly so frequent in gastric neurasthenia as in ulcer. The examination of the contents of the stomach will throw light upon the case. In ulcer there will probably be excess of HCl.

CHAPTER VI.

TREATMENT.

Diet—Digestive Ferments—Lavage—Electricity—Massage—Drugs.

DIET.

IN the dietetic treatment of affections of the stomach, the physician has two distinct indications to carry out—first, to give sufficient food to provide for the nutritive wants of the organism ; and secondly, to adapt what he gives, both in form and quantity, to the digestive capabilities of his patient. In order to do this successfully, he must devote his attention not only to the articles of diet, but also to the time when they are taken and to their quantity. An ideal diet-table for a patient should specify :

1. The exact time when each meal should be taken.

This is important, because gastric troubles are not unfrequently caused either by crowding all the meals into a short space of time, or allowing too long intervals to elapse between them.

It will be found that in most cases we shall have to order smaller and more frequent meals.

2. A list of forbidden and permitted articles of diet.

It too frequently happens that doctors curtail unreasonably the diet of their patients. *Never forbid any article of diet unless there is a distinct reason, based upon the pathological aspect of the case, why it should not be*

taken. It is essential also to provide that the prescribed diet is not too monotonous, as thereby a temporary loss of appetite or loathing of food may easily be induced.

3. The quantity to be taken at each meal must be distinctly specified.

4. The manner in which the food is to be prepared should be sufficiently indicated.

In order to understand the scientific adaptation of diet to cases of indigestion, we must make ourselves thoroughly familiar with the theoretical dietetic treatment of the following groups :

1. Cases where the gastric juice is altered in quality or quantity.

2. Affections in which the movements of the stomach are abnormal.

1. Alterations in the gastric juice.—We may have

(a) *Increase in the quantity or acidity of the gastric juice.*

In these cases we shall naturally expect to find that albumin is readily dissolved, and that the digestion of starch and fat is considerably interfered with.

In the case of the starch, the excess of acid inhibits the action of both the salivary and the pancreatic diastase.

As regards the fat, the continual production of acid precipitates the essential constituents of the bile in the duodenum, and thus interferes with its fat-digesting action.

Under these conditions, therefore, common-sense tells us that we may give as much meat and albumin in the diet as we like, but that we should limit the amount of fat and starch to the minimum absolutely necessary for the nutriment of the organism. Moreover, we must convert the starch as far as possible into sugar before administering it. We should also replace ordinary sugar (which has to be converted into invert sugar before it

can be absorbed) by grape sugar, which can be assimilated without further change. We must also exclude entirely from the dietary vegetables containing much cellulose, such as cabbage, lettuce, carrots, etc.

As regards fat, it has been found that as a rule small quantities of good fats, such as butter, can be digested.

(b) *When the gastric juice is deficient.*—In these cases, the digestion of albumin is carried on vicariously in the duodenum. It will, however, require a longer time, as the food is passed through the stomach almost unchanged. Likewise, the presence of masses of undigested food remaining for some hours in the stomach will give rise to various subjective sensations of pressure or pain.

On the other hand, the digestion of starch will be improved from the fact that the salivary diastase is unneutralized in the stomach, and continues to act during the whole period that food remains in the stomach.

We must, therefore, reverse our measures, and limit the ingestion of meat, and peptonize that before giving it, or else administer one of the digestive ferments with it. We can also with impunity increase the quantity of starchy food.

Another practical point to observe is to limit the quantity of articles of food or drink which can readily ferment, since the antiseptic action of the HCl will be diminished. We should, therefore, allow in moderation articles of diet which act anti-zymotically, such as mustard and alcohol.

2. Where the Movements of the Stomach are Abnormal.—When there is an atonic condition of the walls of the stomach, we must obviously avoid overtaxing the lax muscular tissues, and must administer food rich in albumin and poor in water, in small quantities, at frequent intervals. It is of the utmost importance that the stomach should not be overloaded

with liquid. We are fortunately able in very severe cases to give nearly all the liquid required by the organism in the form of enemata.

Acute Gastritis.—The great remedy, whether the stomach has been evacuated or not, is complete abstinence from food for several hours, during which time the patient may with advantage suck small pieces of ice. If there is great prostration, but not otherwise, small quantities of well-diluted brandy may be cautiously given.

After the acute symptoms have subsided, any of the following articles of diet should be given in small doses every two hours :

Milk and soda-water, milk and lime-water, veal broth, chicken broth, barley-water, rice-water, or thin soup.

In some instances the patient will be practically well as soon as the contents of the stomach have been evacuated ; but in other more severe cases this will not be so, and he must be kept upon the following regimen for several days, only being allowed to return very gradually to his ordinary diet :

At 10 o'clock.—A small glass of milk and lime-water, or a cup of beef-tea with a small piece of toast.

1 o'clock.—A basin of soup or beef-tea with a little toast.

4 o'clock.—A cup of thin cocoa, made with half milk, or a cup of weak tea, and a thin slice of bread-and-butter.

7 o'clock.—A basin of soup or broth.

9.30 to 10.—A cup of water-arrowroot, with a teaspoonful of brandy in it, or a glass of milk and lime-water.

Mellin's food, peptonized milk, or milk-gruel, may be substituted for any of the above articles.

As convalescence approaches, the patient may be allowed purées of meat or chicken, lightly-boiled eggs, boiled soles,

or raw oysters. For some little time he should confine himself to the diet given for chronic gastric catarrh.

Chronic Gastritis.—In an ordinary case some such diet as the following should be insisted on :

Breakfast.—A basin of bread-and-milk, or a cup of Schweitzer's cocoatina, a little boiled fish, or a poached egg and a slice of dry toast.

Lunch.—The lean of a mutton chop, or a grilled sole. A slice of toast. A glass of milk and soda-water, or a little weak spirit and water (1 in 10). If the patient cannot manage this, a little custard-pudding only, or a few oysters, may be taken.

Dinner.—Boiled or grilled white fish ; boiled, roast, or grilled fresh meat. A tablespoonful or so of boiled green vegetables. Potatoes cooked in their skins, mashed with milk, and passed through a hair-sieve. A little stewed fruit or milk-pudding. A little weak spirit and water, or a glass of any light wine, or a small bottle of Apollinaris water.

It is of the utmost importance to insist upon three meals a day, and no more, and these at intervals of five or six hours. *Nothing whatever must be taken between meals.*

On rising in the morning, a tumbler of hot water should be slowly sipped whilst dressing. This will wash away any mucus which may have accumulated during the night, and will materially increase the appetite for breakfast. This *toilet of the stomach* is most important, and puts this organ into the best possible condition for undertaking the digestive duties of the coming day.

If there is any tendency to morning sickness, the water must be taken in bed before rising, and half a teaspoonful of bicarbonate of soda should be added to it.

It is important to make the patient understand perfectly that the water is not to be drunk off at once, *but is to be slowly sipped*, and that it must be as hot as can be taken with comfort.

If there is any tendency to constipation, a teaspoonful of Carlsbad salt may be added to the water as many times a week as may be necessary to secure a daily action of the bowels. See also pp. 263 and 264.

Alcoholic Dyspepsia.—Of course, the first thing to do is to absolutely prohibit alcohol in every form, or, at least, to cut it down to a minimum.

IN SLIGHT CASES the diet I usually prescribe is as follows :

A tumbler of hot water to be sipped on rising.

Breakfast.—A little grilled fish or bacon, a lightly-boiled egg. Dry toast, weak tea or thin cocoatina.

Lunch at 1.—The lean of a mutton chop, or a slice from a roast joint of beef, mutton or lamb, or a little chicken or game. A little boiled green vegetable, and a tablespoonful or so of well-mashed potato. Dry toast or stale bread. One tablespoonful of whisky in a bottle of Apollinaris water, or a glass of milk and lime-water.

4 p.m.—A cup of weak tea and a biscuit.

Dinner at 7.—The same as lunch, with the addition of a little stewed fruit or a milk-pudding.

IN MORE SEVERE CASES.—A glass of hot water before getting out of bed, slowly sipped.

Breakfast at 8.—A basin of soup with a bit of toast, or a cup of beef-tea or chicken broth.

At 10.30.—A tablespoonful of any reliable meat-juice, such as Valentine's, or a cup of peptonized milk.

Dinner at 1.—The lean of a mutton chop, or a slice of underdone roast meat that has been passed through a sausage-machine and warmed up with a little gravy (from the meat). Dry toast ; a tumbler of milk and soda-water. A few oysters may be allowed.

4.30.—A cup of weak tea and a little toast.

Supper at 7.—A basin of soup or mutton broth, with a rusk or a little toast.

10.30.—A glass of hot water.

Hyperchlorhydria.—Everything that can irritate the coats of the stomach must be interdicted.

The diet must consist mainly of nitrogenous food, both because it is easiest digested, and also for the reason that it possesses the advantage of entering into combination with HCl and thus alleviating the pain by diminishing the quantity of free acid in the stomach. Any kind of meat may be taken, even such as possesses the reputation of being difficult of digestion; but it must in all cases be plainly cooked, either roast, boiled, or grilled. Eggs and milk should form an important part of the dietary, as they are rich in albumin, and are thus very effective in masking pain. Indeed, patients usually find this out for themselves, and are in the habit of taking a beaten-up egg or a glass of milk two or three hours after a meal to dull their pain. The eggs must be very lightly boiled, and the milk sipped very slowly. The reason why the milk must be taken in sips is in order that it may be curdled in fine flakes, and not in a solid lump. This would certainly happen if a glassful were taken at a gulp. In these patients the milk-curdling ferment is always in excess, and consequently the curdling of the milk is very energetic. This fact will possibly explain the assertion of many sufferers from hyperchlorhydria, 'that they cannot take milk, as it always disagrees, and makes them bilious.' I find that patients usually describe an attack of acute dyspepsia as 'biliousness.' Therefore when we are told positively by a patient that milk does not agree, we must not attach too much weight to the statement and exclude it from their dietary until we have tested the effect of taking it in sips. Another point of great importance is to regulate the amount of salt taken. The quantity used in cooking and taken with the food must be reduced to a minimum, for the obvious reason that from it is derived eventually a large proportion of the acid of the gastric juice. All substances,

such as pickles, spices, and strong sauces, that can excite the secretion of gastric juice, must be absolutely avoided. As the absorption in the stomach is normal, and since there is, as a rule, no dilatation, the patient need not be restricted in his drink, and may take milk and water *ad lib.*

Moreover, we must bear in mind that a certain amount of fluid is of a distinct advantage, both because by diluting the hyperacid gastric juice it will help to diminish pain, and also because it will favour the process of peptonization, which is retarded if the stomach contents are concentrated beyond a certain point. Instead of milk, a little red or white claret may be added to the water, or koumiss may be taken if relished by the patient. All strong wines, spirits, liqueurs, tea, and coffee, are to be absolutely avoided. As the object of treatment is to secure as much functional rest for the stomach as possible, only three meals a day should be taken, and nothing whatever between them, however much the patient may be tempted to do so to relieve his pain.

Hypersecretion.—What has been said under the head of hyperchlorhydria will be also applicable to this complaint, but there is one point to which additional attention should be given—that is, the regulation of the quantity of drink allowed the patient. This is often necessary on account of the presence of dilatation—a condition that does not, as a rule, occur in hyperchlorhydria. Since in hypersecretion the absorptive power of the stomach is much below the normal, the bulk of fluids taken will accumulate in the viscus, and assist in dilating it. It is therefore necessary to regulate the amount of liquid taken without going to the extreme of an absolutely dry diet. It must always be borne in mind that a certain quantity of water is necessary for the needs of the system, and this is especially so in subjects of hypersecretion, in whom the urinary secre-

tion is already less abundant than normal. We can with advantage in these cases supplement the fluid given by the mouth by enemata of plain water given several times a day.

Ulcer.—The treatment of the ulcer of the stomach, in order to be successful, must be carried out in a systematic manner. To explain my meaning we will consider the treatment of an ordinary case of ulcer in an active condition, in which there has been an attack of hæmatemesis some weeks ago, but no bleeding after the first few days. There are now attacks of characteristic pain followed by vomiting, and the examination of the vomited matters demonstrates the presence of hyperchlorhydria. The treatment of a case of this description is divided into three stages.

First Stage.—We either absolutely cease or greatly reduce the amount of food given by the mouth. The patient is confined to bed, and has applied to the epigastric region a compress of two folds of lint covered with oilsilk and saturated with water, and then wrung out nearly dry. Every morning, the first thing, the patient takes by little sips a glass of cold water containing a teaspoonful of bicarbonate of soda. Nothing else is given by the mouth except a few bits of ice or a few sips of cold water occasionally to relieve the thirst.

Nourishment is carried on entirely by the aid of nutrient enemata, of which five or six a day will be required. In addition to these, one consisting of ten ounces or so of tepid water must be given to provide the liquid, which is just as important to the organism as other alimentary substances.

I do not think that there is any advantage to be gained by giving complicated enemata containing peptone and other prepared foods, as it has been demonstrated that plain albumin is quite easily absorbed from the intestinal canal. In my own practice I follow Ewald, and

use the mixture which he has devised, consisting of a tumblerful of a 20 per cent. solution of sugar beaten up with three eggs and a pinch of salt. I have also had very good results from the use of defibrinated ox blood, to be procured from any wholesale chemist. The first injection in the day should be a laxative one to open the bowels. When this has acted, the plain tepid water enema should be given and allowed to remain. When this has had time to become absorbed, the first nutrient enema is to be given. It is a good plan to give a plain water injection the last thing at night, and to this may be added with advantage a few drops of an opiate. This period will last from four days to a week.

Second Stage.—The administration of food by the mouth is to be cautiously resumed. We commence by giving half a pint of milk a day in divided doses, making the patient drink it slowly in tiny sips. If this is tolerated well, we gradually increase the amount, feeling our way until we give one or two quarts a day. At the same time, *pari passu* with the increase of the quantity of food given by the mouth, we diminish the number of enemata until finally we stop them altogether. This second period will be of two or three weeks' duration.

Third Stage.—We now commence to give more solid food. We begin by thickening the milk with some farinaceous material such as baked flour, or one of the prepared infants' foods. We then add to the dietary broths and soups, at first thin and afterwards thickened with pea or bean flour. A very good thickening material, which I have found of great utility in the treatment of this stage of ulcer of the stomach, is one of the partially digested beef meals which can now be obtained. I have had most experience of Mosquera's beef-meal. It contains powdered beef, which has been partially converted into albumose and peptone. Peptonized gruel and peptonized soup will also be very useful at this stage.

It is as well to bear in mind that there are two methods of making peptonized soup, the one by mixing equal parts of a thick peptonized gruel with strong stock, and the other by using a thin peptonized gruel instead of water, to extract the nutriment from bones, meat, etc., in the ordinary way of manufacturing stock.

As soon as the stomach will tolerate these articles of diet, we venture on a panada, which may be defined as a mixture of cooked meat or game, bread, and milk divided finely enough to pass through a hair sieve. Every cook ought to know how to make one. Unfortunately, most of them are ignorant even of the name.

And thus we gradually return to the normal diet. As we increase the solidity of the meals we diminish their frequency until we arrive at the regulation three meals a day.

Dilatation.—The composition of the diet must depend upon whether there is hyperchlorhydria or anachlorhydria. In the former case the diet of hypersecretion will be given, in the latter that for chronic gastritis. The articles of food chosen should contain as much nourishment in as small a bulk as possible. The patient should have three meals a day with an interval of four hours between the first and second, and six or eight between the second and third. The chief difficulty will be found in the administration of liquid. The needs of the organism require that a certain quantity of water should be taken during the twenty-four hours—a quart at least. In dilatation of the stomach we have particularly to avoid overloading the stomach with water. The dilemma may be overcome by the use of fractional doses of liquid—a wineglass with each meal, and half a wineglassful every half-hour between meals until the required amount has been taken.

If enough cannot be taken by the mouth it may be given in the form of an enema, as we do in certain cases of hypersecretion. This is best carried out at bedtime,

ten ounces or more of tepid water being slowly introduced into the rectum.

Cancer.—It is impossible in most cases of cancer to lay down very strict rules for diet. One of the chief troubles in this complaint is loss of appetite. If we unduly restrict the diet we shall in all probability increase the anorexia. With certain reservations, we must feed the patient very much as in chronic gastritis. We must be guided in our selection of articles of diet by our common-sense and the knowledge which we have of the functional gastric derangements accompanying cancer. We know that the motility of the stomach is usually weakened, and that there is dilatation, and that the digestive power of the stomach is lessened. We must, therefore, avoid alimentary substances which would be liable to ferment if retained an abnormally long time in the stomach in an undigested condition. Therefore we instruct the patient to eliminate from his diet-table underdone meat, new bread, raw vegetables, Camembert, Brie, Gorgonzola and cream cheese. Patients with cancer appear to instinctively find this out for themselves, and early lose their appetite for these things. We must not forget that although the albuminoids are not peptonized in the stomach, they are eventually digested in the intestine. We must therefore not reduce their quantity too much, but take care that they are well cooked. Theoretically, meat - powder and peptones should be eligible preparations. Practically the patient soon exhibits a distaste for them, and cannot be induced to take them. Patients are very unreasonable, and in very many cases, even when they know how much is at stake, cannot be persuaded to take what is good for them unless they happen to like it. I have given Mosquera's beef-meal with great advantage in this affection. This valuable preparation has already been mentioned in the section on the diet suitable for ulcer of the stomach.

The diet should consist mainly of dry toast, rusks, milk, milk-puddings, biscuits, eggs, fish, and well-baked fruits. There is no objection to any relishes which may possibly rouse a failing appetite. Anchovy paste in small quantity on toast may often be taken with advantage. Macaroni, with a little good gravy and a sprinkling of Parmesan cheese, will often tempt the failing appetite when nothing else can. Koumiss and Kephir koumiss are often well tolerated. As regards drink, this must be of small amount, as we must bear in mind that absorption from the stomach is slow, and any excess of fluid would tend to increase any dilatation which may be present. Beer must be avoided as a rule, although some of my patients have apparently taken bottled Bass or Pilsener with advantage. A *dry* champagne may often be taken, particularly if it contains a small quantity of liquid extract of coca or cocaine. This is of distinct advantage in certain cases of cancer, as it tends to deaden the sensibility of the stomach and enable the wine to be tolerated. Coca wines made with sherry or cheap sweet champagne must be absolutely avoided. As regards the number of meals, I have tried six or seven a day, and have abandoned this method in favour of three.

Gastric Neurasthenia.—We may take it that, with very few exceptions, the cases of functional or atonic dyspepsia that we meet with in practice at the present day are due to want of nerve tone, or to nerve-poisoning by absorbed toxines, and the success of our treatment will depend very largely upon whether we recognise the cause or not. And, moreover, these cases are often much more complicated than they at first appear to be. For example, the defective innervation of the digestive apparatus leads to imperfect digestion and, consequently, diminished assimilation of food. The body is therefore imperfectly nourished. As a necessary consequence the nervous system participates in the general malnutrition,

and, reacting again in turn upon the stomach, perpetuates the dyspepsia. *Thus is set up a vicious circle of disease which it is very difficult to break.* Now, we can easily see that we cannot possibly hope to cure a case of this kind by further restricting a diet which the patient has in all probability himself curtailed below the requirements of health, by voluntarily leaving off everything that he has found to disagree with him.

We have here to pursue the exact opposite course to that required in chronic catarrh. There we had to limit the food, here we have to build up, and must consequently try and induce the patient to take as much nourishment as possible, *whether it produces discomfort or not.* It is therefore almost impossible to prescribe a strict diet table. Rather administer food according to the following rules :

Do not restrict the diet beyond avoiding things which are palpably indigestible. Rather increase the number of meals.

If it is found that any article of food (not naturally indigestible) disagrees, *do not cut it off entirely*, but merely restrict its quantity. This is very important, as the stomach, through disuse, may easily, so to speak, *forget* how to deal with any particular article of food on a future occasion.

Of course all this only applies to plain, wholesomely-cooked food. All made dishes, smoked or highly-seasoned entrées, must be avoided, but the diet must not be allowed to become too monotonous, or the appetite may fail. We must tempt the patient to eat with delicately-prepared and dainty dishes. But, above all things, we must avoid giving food that is *too* digestible. Bland, un-irritating food, carefully freed from cellulose and vegetable and animal fibres, is not sufficiently stimulating to the alimentary canal to cause a daily evacuation of the bowels. In short ;

(a) The food must be nutritious and plainly cooked.

(b) It must be given at comparatively short intervals. A raw egg, beaten up with a teaspoonful of old brandy and a little milk, may often be given with great advantage between breakfast and lunch, and between lunch and the late dinner.

(c) The appetite of the patient must be taken as the best guide to the most suitable kind of food. It will frequently be found that what patients *fancy* will frequently agree, if they are allowed to take it at the time they fancy it. Nature is not such an unreliable guide, if we listen to her dictates with discrimination.

(d) The food must be well masticated. If necessary, the teeth should be put in order by the dentist.

(e) In cases where there is excess of acid secreted we may give an excess of animal food.

(f) Where we have reason to suppose that the gastric juice is defective we may either peptonize the articles of diet, or administer one of the digestive ferments at meal times.

In cases where gastralgia is set up by certain articles of diet, such as cold drinks or highly-spiced dishes, we should obviously avoid these. But in ordinary cases we must not attempt to diet the patient at all. It is frequently found that articles of diet which will agree perfectly well at one time, at another will give rise to discomfort. In these patients, however, idiosyncrasies towards special articles of diet are often present, and these should be respected. It is a mistake to be over-rigid in the diet, as starvation of the body increases the atony of the stomach, and thus produces the very opposite effect to that which we require. There are three main principles to bear in mind :

1. Reduce the quantity of farinaceous materials, such as bread and potatoes.

2. Increase the amount of fresh meat taken.

3. Get the patient to take as much fat in a digestible form as possible, *e.g.*, fresh butter well rubbed into thin slices of stale bread ; cold boiled fat bacon.

In severe cases, give peptones or pancreatized milk, or milk foods.

DIGESTIVE FERMENTS.

Malt Extract and Malt Infusion.—We possess in these agents a means of artificially assisting the digestion of starch in cases where this process is inefficiently performed. This may occur either when the diastatic power of the saliva and pancreatic juice is in defect, or when these fluids are unable to exercise their function owing to abnormal conditions in the stomach or duodenum.

We possess very little absolute knowledge of abnormalities of the salivary diastase, and none at all respecting that of the pancreas. But we know something about the conditions under which the diastatic action of the saliva may be checked. We have seen that in the process of normal digestion the action of the salivary ferment is arrested by the acid gastric juice, and again revived in the alkaline duodenum. When the hydrochloric acid in the stomach is in excess, its long-continued and powerful action so lowers the vitality—if one may use such an expression—of the ptyalin, that it is unable to recover itself.

Under these circumstances the abnormally acid chyme which is thrown into the duodenum will act in a similar manner, and inhibit the diastatic ferment of the pancreatic secretion.

We shall thus have the diastatic action almost in abeyance, and we must strive to assist nature to dispose of the starchy portion of our food, or it will pass through the system undigested.

We possess in infusion of malt an agent vastly superior to the malt extracts of commerce. It has the great

advantage of being within the power of anyone to prepare. The following is one of the best methods :

Three ounces (three piled-up tablespoonfuls) of crushed malt are thoroughly well mixed in a jug with half a pint of cold water. The mixture is allowed to stand overnight—that is to say, for ten or twelve hours. The supernatant liquor is then carefully decanted off from the sediment, and strained through two or three folds of muslin until it comes through fairly clear and bright. The above quantities yield about six ounces of extract.

The action of the above upon starch is quite as powerful as the average specimens of malt extract. It should be prepared fresh for each day's consumption, or if it is required to be kept, a few drops of chloroform should be added to it, and the bottle containing it well corked. If, before using it, the dose is placed in a saucer two or three hours previously, and allowed to stand in a warm place, the chloroform will evaporate, and the original flavour of the extract be restored.

Malt extract may be given in two ways :

1. With the food. (It is best used as a beverage, and sipped whilst the farinaceous part of the meal is being taken.)

2. Three or four hours after the meal, in conjunction with a dose of alkali.

It is best given this way in cases of hyperacidity of the stomach, or duodenal dyspepsia.

The dose of either the malt infusion or the malt extract of commerce is one or two tablespoonfuls.

Pepsin and Pancreatin.—It is, unfortunately, too often the case that these agents are prescribed in dyspeptic conditions for which they are quite unsuitable. They are really very seldom indicated. In this contention I am supported by Boas, whose work* is, I believe, one of

* 'Allgemeine Diagnostik und Therapie der Magenkrankheiten,' Berlin, 1890, pp. 254, 255.

the most recent and authoritative upon the subject of diseases of the stomach.

The following is a translation of his words, the observations in brackets being my own :

‘The indications for prescribing preparations of pepsin appear to be theoretically clear ; we ought to give it in cases where the mucous membrane of the stomach secretes too little peptic ferment, or none at all.

‘In practice, however, this rule undergoes essential limitations. We must distinguish between two different conditions. The first is when the secretion consists entirely or almost entirely of pepsinogen [that is to say, without any HCl] ; the second is when very little or no ferment is secreted.

‘In the first case the administration of pepsin is not necessary, as only hydrochloric acid is required to convert the pepsinogen [proenzyme] into an active ferment.

‘In the second case, it is true, the introduction of a peptic ferment into the stomach is very desirable ; but *pepsin is not suitable for this purpose*, on account of its requiring such an enormous quantity of hydrochloric acid to give efficiency to it, and this amount of acid cannot be administered without causing subjective or objective disturbances. [Note.—You hardly ever get an absence of peptic ferment in the stomach without concomitant deficiency of HCl.]

‘Accordingly, in my opinion, the proper sphere of action of pepsin is limited to those exceedingly rare cases where there exists a disproportion between acid-secretion and pepsin-secretion.

‘This only occurs in cases of hyperacidity [of HCl] and excessive secretion of gastric juice. In severe cases of this kind one may essentially promote digestion by the addition of pepsin, as Gerhardt and Sticker, likewise Bonk, have shown ; but according to Trzebinsky in my

laboratory, such cases always have an acidity of over 25 per cent.'

'The sole indication [that is, the only circumstance under which it can be given] is the deficiency, or better still, complete absence, of HCl. It is especially suited to those cases where it is improbable that there is any gastric juice secreted at all.'

Pancreatin would, at first sight, seem likely to be an efficient substitute for pepsin, until one remembers that its activity is destroyed by the presence of an acid. Moreover, even if combined with sufficient alkali to protect it in its passage through the stomach, the digestion which it would effect would be limited to the duodenum; and our object is not to render this intestine a substitute for the stomach, but to promote digestion in the latter organ.

This difficulty of passing the pancreatin intact through the stomach has been ingeniously overcome by Messrs. Burroughs and Wellcome, who make a tabloid of zymine (pancreatin) coated with keratin, a substance soluble in the alkaline contents of the duodenum, but not in the acid stomach. In my own practice I have now discarded pepsin given by the mouth, in favour of infusion of malt or malt extract, when I wish to help the digestion of starch; and pancreatin in keratin-coated tabloids or papain, when I wish to act upon the proteids.

Papain.—This is the active principle of the juice of the trunk and fruit of the *Carica papaya*, or South American melon-tree, which grows in the Brazils, West and East Indies, in the Molucca Islands, and, in fact, in all tropical climates.

It is prepared by treating the juice with alcohol, which precipitates the ferment.

The inspissated juice of the plant is also sold in this country in a powdered form under the name of 'Succus

Papayæ,' but is far inferior to papain itself for medicinal purposes.

Papain (Finckler) will digest 1,000 to 2,000 times its own weight of moistened fibrin when warm, and softens muscular tissue in half an hour.

Although so powerful, living membranes are not acted on, and 30 to 75 grains have been administered to dogs and rabbits without any untoward result.

It acts in either acid, alkaline, or neutral solutions, and when it has once come into contact with fibrin, adheres to it with such tenacity that no amount of washing will remove it or stop its action.

Amongst the products of its action are albumose and true peptone.

It has been asserted by some observers that the product of the action of papain upon meat and fibrin was not true peptone.

For practical purposes, it does not much matter whether such is the case or whether the change falls a little short of this, as the resulting bodies would be as easily dealt with in the organism as peptone itself.

As a digestive ferment to be given medicinally, papain presents the following advantages over pepsin and pancreatin :

1. It will convert or digest many more times its own weight of meat than they are able to.

2. It can be used when pepsin and pancreatin are contra-indicated, or powerless.

This is the case when

(a) The stomach contents are too highly concentrated. Pepsin ceases to be able to act when this obtains beyond a certain point. On the other hand, papain acts energetically even when the sp. gr. of the stomach contents reaches 1.030 or over.

(b) When there is such a deficiency of HCl in the stomach that pepsin is inactive.

Pepsin, as we know, can only act efficiently in the presence of a certain quantity of acid—that is to say, that the inactive proenzyme requires a certain percentage of acid to convert it into an active ferment. Papain, on the other hand, being independent of the presence of an acid, will do its work even under these conditions.

(c) When the stomach contents are so acid that when poured out into the duodenum they inhibit the action of the pancreatic ferment.

It not infrequently happens, in cases of hyperacidity of the stomach, that the intestinal juices are unable to neutralize the intensely acid chyme. As the pancreatic ferment can only act in the presence of an alkali, duodenal digestion is at once arrested, and various unpleasant symptoms supervene.

It is obviously of no use to give pancreatin by the mouth, unless in the form of a keratin-coated tabloid, as it is at once destroyed by the acid in the stomach. And in these cases it is of no use to give an alkali with it, as is often done, as it would be practically impossible to give a sufficient dose to neutralize the contents of the stomach without damage to the organism. Papain is here of the greatest use, as it is not affected as to its activity by contact with acid.

3. As regards albuminoids, it combines in itself the joint action of pepsin and pancreatin.

4. It can be given combined with acids, alkalies, or antiseptics, as indicated by the demands of the case.

5. It has a local action on the stomach that pepsin has not.

(a) It has a distinct tonic action on the secreting mechanism of the stomach, stimulating the secretion of gastric juice.

(b) It has a local sedative action, relieving pain in a marked degree, and this it does whether the pain is due to the presence of irritating ingesta or is a local neuralgia.

(c) It dissolves unhealthy mucus coating the interior of the stomach, and interfering with the gastric secretions and the absorption by the stomach walls.

This condition is met with chiefly in the chronic stomach catarrhs of children, in cases of alcoholic dyspepsia, and in most cases of chronic gastritis.

(d) It is distinctly antiseptic in its action.

It thus prevents the abnormal fermentative processes from taking place in the stomach and intestines. An important point in its favour is that it can be given in conjunction with other antiseptics, such as salol, when necessary, without its action being in any way interfered with. This is not the case with pepsin.

6. And last, but not least, it is not so repulsive in idea as pepsin, as it is purely vegetable.

With animal ferments, prepared from stomachs of pigs and other animals, there is always a possible doubt as to the freshness or healthy condition of the material. If at all tainted, it may contain bacilli, ptomaines, and other toxic substances, particularly as, in preparing pepsin and pancreatin, it is impossible to raise the temperature high enough to destroy these without rendering the ferment also inert.

From a consideration of the foregoing, we see that papain is indicated in the following conditions :

1. Deficiency of the gastric juice from—

(a) Atrophy of the gastric follicles.

This is usually consecutive to long-standing chronic catarrh.

(b) Deficient blood supply.

This sometimes occurs in anæmia and general debility.

2. Excess of unhealthy mucus in the stomach.

This is met with in chronic gastric catarrh, chronic alcoholism, and in the chronic stomach catarrhs of children.

3. Irritable conditions of the stomach associated with pain and vomiting.

When its local action is desired, it is given on an empty stomach; and when it is administered for its digestive effect, it may be given either with the food or shortly after.

WASHING OUT THE STOMACH, OR LAVAGE.

The cases in which this procedure is of value are those in which from any cause the stomach is unable to completely empty itself at the end of the digestive periods. The food consequently remains too long in it, and undergoes fermentation. In addition to this, lavage of the stomach is most useful in certain neurasthenic cases, where it appears to act beneficially by a kind of massage of the interior of the stomach.

The good results obtained by lavage of the stomach in suitable cases may be summed up as follows:

1. The most important is the cessation of vomiting, as many of the other ameliorations in the patient's condition depend upon it.
2. The patient is spared the very distressing period of pain, weakness, and nausea which usually precedes the actual attack of vomiting.
3. Pain is very much diminished.
4. The bowels often become regular.
5. Appetite is improved.

These important effects are not surprising when we consider what we are doing. We completely effect what Nature has been endeavouring with only partial success to accomplish. We empty the stomach of all the fermenting material which has accumulated there, and which would increase until sufficient discomfort had been induced to cause vomiting. We thus anticipate the act of vomiting, and spare the patient not only the suffering attending the act itself, but the discomfort which has led up to it. We remove the irritating, pain-

producing stomach contents, with the result that gastritis, also a cause of pain, diminishes or is cured. Thus, by one procedure the two commonest causes of pain are removed. And by thus preventing over-distension of the stomach we put within its power the possibility of regaining its contractility.

Technique of Lavage.—This is very simple. The best tube to use is a fine silk gum-elastic stomach-tube. These are very nearly as flexible as indiarubber, are easier to introduce, are smoother, and have a larger lumen. Over the end of such a tube is slipped a rubber tube four feet long, terminating in a funnel. The patient sits in a chair, with a pail in front of him between his knees to contain the washings. The tube should, if possible, be lubricated with the patient's own saliva by drawing it through his mouth. If this cannot be done, milk or cream is the best to use. The tube is now passed into the patient's stomach in the manner described on p. 120. The funnel is now raised above the patient's head, and about a pint of warm water introduced into the stomach. Just before the funnel is quite empty, the rubber tube just below it must be nipped between the finger and thumb, so as to prevent the water with which it is filled leaving it. If the funnel is now lowered, syphonic action will be established, and the contents of the stomach will flow into the pail. Fresh quantities of water are now successively introduced into the stomach, and drawn off until the washings come away quite clear.

The following are the indications for lavage in the different affections of the stomach treated of in this book :

Acute Gastritis.—The only form of acute gastritis in which lavage is necessary is that in which the inflammation is the result of a toxic agent which has been swallowed. Since the first indication is undoubtedly to

remove the noxious substance as quickly as possible, and spontaneous vomiting may not occur soon enough, or empty the stomach completely, we must bring science to aid us. We may wash out the stomach if the poison is a non-corrosive one, but we must on no account attempt to do so if—

1. The poison was a mineral acid or caustic alkali.
2. If we know that ulceration of the stomach is present.

Chronic Gastritis.—In this affection lavage is of extreme value both in severe and slight forms. When dilatation has taken place it is, of course, necessary. In milder cases it causes abnormal fermentations in the stomach to cease, clears away mucus from the walls of the stomach, and enables direct application of medicinal substances to be made. In treating cases of chronic gastritis, it is best to intermit the lavages at the end of every ten days. When applying medicated solutions, the stomach must first of all have been well washed out with plain warm water. Among the liquids which have been found useful in appropriate cases are—

1. Solution of boric acid, 5 in 1,000.
2. Solution of salicylic acid, 1 in 1,000.
3. Vals or Vichy water.
4. Nitrate of silver, 0·5 in 1,000.

(This must be immediately followed by a douche of salt water.)

5. In my own practice I now almost invariably use a tabloid made by Burroughs and Wellcome, containing the following formula :

R	Sodii Chloridi	-	-	3j.
	Potas. Chloridi	-	-	gr. vj.
	Sodii Phosph.	-	-	gr. iiij.
	Sodii Carb.	-	-	gr. xx.

M. Divide into three tabloids.

Three of these tabloids dissolved in two pints of tepid water make an ideal solution for washing out the stomach.

Hyperchlorhydria.—Lavage of the stomach is not indicated.

Hypersecretion.—Washing out the stomach is one of the very best methods of treating this affection. The frequency of washings must be regulated by the amount of gastric retention and the quantity of secretion. In mild cases one a day is sufficient, and this is best given just before the last meal. Where the dilatation is very great, a washing may be administered before breakfast in addition. If the crisis of nocturnal pain is very violent, the operation should be performed as soon as it commences to be felt, and the patient will thus secure several hours' sleep.

Either plain water or water containing bicarbonate of soda, or the tabloids already mentioned, is to be used.

Ulcer, Cancer.—In these affections lavage is inadmissible.

Dilatation of the Stomach.—In addition to what we have already said as to the use of lavage in this condition, the following points claim our attention:

1. If we remove too much of the products of digestion, we shall starve the patient. Our lavages must, then, be done as long after a meal as possible, and not more frequently than is absolutely necessary.

2. The number of our washings must depend upon the degree of retention, and the activity of the abnormal fermentative processes. At first we may have to give two a day, but after a week or so, when the gastric condition has improved, one a day will perhaps be sufficient. After a few weeks we may be able to reduce the number to one every few days.

3. The time when the washings are to be given. In

this we must be guided by the condition of the patient and the purpose for which they are given. As a general rule we may bear in mind that—

(a) A washing before breakfast removes the smallest quantity of absorbable food from the stomach.

(b) A washing the last thing at night will probably ensure a good night's rest.

Gastric Neurasthenia.—In certain cases lavage of the stomach gives very good results. It appears to act as a kind of internal massage of the stomach, and besides quieting hyperæsthesia of the nerves, exercises a mildly stimulating action upon the muscular walls. In my own hands it has proved of great use in two cases of severe gastralgia, associated with anachlorhydria, which had resisted all other treatment.

ELECTRICITY.

We can have no doubt but that electricity is one of the most valuable agents that we possess in the treatment of certain forms of gastric disease. But to be of any use it must be applied by an expert, and *never by the patient*.

There is nothing magical in electricity, that it will cure disease however it is applied. Indeed, it requires very considerable practice and study to be able to produce any good effect with it at all. A person who buys a battery and attempts by the light of Nature to apply the current to himself is more likely to do himself harm than good, as it is in the last degree improbable that he will by accident hit on anything approaching the correct way of using the current to benefit the disease from which he is suffering. The patient, quite unconscious of the fact that there are three kinds of electricity in common use, and several methods of application, each of which is capable of various modifications, and being ignorant of the fact that there are some constitutions so extremely

susceptible to electricity that it has to be applied at first with the greatest caution, and varied during the progress of the case to suit its different phases ; being unconscious of the fact that it is not electricity in the abstract, but electricity intelligently applied by an expert, that cures disease, *determines to get a battery and try electricity*. A patient who has done this, and naturally failed to get any good result, will very often, when you propose to treat him with a galvanic current, tell you that 'he has tried electricity.' As Beard and Rockwell appositely observed : 'As well might a sailor whose broken bone had been badly set by a comrade before the mast, declare that he had tried surgery.'

Apparatus Required.—No man can do efficient work without proper tools, and it will save time if I first of all enumerate and describe the minimum amount of apparatus necessary to carry out in a proper manner the various methods of treatment that I shall give directions for performing.

1. *A Battery of Cells.*—Until recently, the most convenient ones were the Léclanché cells, modified by Leiter, of Vienna. These can be recharged by the physician himself, without having to send them back to the manufactory for that purpose, as you have to do with the ordinary commercial Silvertown Léclanché cells. They are only a trifle more expensive, and are better finished in every way. One great advantage of them is that they have binding screws to both carbon and zinc, so that they can be readily connected up without soldering, and can as easily be removed from the circuit.

But now a number of different kinds of dry cells can be obtained which leave nothing to be desired in the direction of efficiency or convenience. Most of these are Léclanché cells, modified in the following way : The zinc is utilized to form the outer case or covering, the agglomerate carbon is in the centre, and the space

between is filled with a jelly containing the chloride of ammonium. It has been found that this jelly is quite moist enough to set up the required action upon the zinc and carbon. One of the best cells is the L  clanch  -Barbier. In this the central carbon is made hollow. The advantage of this is that when the jelly becomes dry it can be again moistened by the introduction of fresh sal-ammoniac solution through the carbon. The life of the cell is thus more than doubled.

It is portable, cleanly, and thoroughly constant, and can be used for electric light, electrolysis, faradization, and physiological purposes. Its electro-motive force is high, and its internal resistance is low. I can strongly recommend this cell to be used in preference to any other.

2. *A Dial Collector*, by which the cells can be brought into circuit one by one without any perceptible break or shock. The latest and best collector is so constructed that cells can be brought into circuit from any part of the series. This is an advantage, both because it enables you to use all your cells equally, and also because you are able to examine the electrical condition of any single cell without removing it from the battery; or,

3. *A Rheostat*.—This is an arrangement by which so much resistance can be introduced into the circuit that no current can pass at all. This resistance being then gradually withdrawn, the current is increased without any break or shock.

Either the dial collector or the rheostat can be used for graduating the current before it reaches the patient. For portable batteries the collector is the best, but for large fixed batteries I prefer the rheostat. It enables the cells to be connected up in series, and thus to be used up equally. The rheostat I have found to be the best is the Bailey rheostat manufactured by the Law Battery Company, New York.

4. *A Galvanometer* measuring the current in miliampères. What is known as a 'dead beat' galvanometer is best, as the needle moves at once into its place without any of the annoying oscillations which were present in the old form of instrument. In practice, it will be found a great convenience to fix a circular mirror in such a position over it as to reflect the scale in such a manner that it can be easily seen without having to look over the top of the instrument. Edelmann's galvanometers are practically the only ones in use at the present day among experts.

5. *De Watteville's Key, or its Equivalent*.—This is an arrangement by which you can reverse the current, or cause to pass through the same terminals either the continuous current or the interrupted current, or both combined.

6. *A Faradic Coil*, with a key for switching it in and out of circuit, and provided with a couple of cells of its own to work it.

With the exception of the rheostat, the whole of this apparatus may be procured combined in a moderately portable case, and this is the best form for the general practitioner to possess, as he is thus enabled to use it if necessary on patients at their own homes as well as at his consulting rooms. An arrangement of this nature is described in catalogues as 'A Combined Battery, with double collector, Current Reverser, Galvanometer, Dubois-Reymond's Sledge Coil, and Dr. de Watteville's Commutator.'

Besides the apparatus enumerated above, there will be required a pair of conducting cords, or rheophores, as they are called, and a set of electrodes, or pads for applying the current.

And here I would say that it is not at all necessary to procure a large assortment of electrodes of different sizes. The following are all that are absolutely necessary for the methods of application I shall describe—

1. *A Large Flat Circular Sponge on a Wooden Base.*—After an extended experience I have come to the conclusion, and I believe that my opinion is shared by most of those who make an extensive use of galvanism in their practice, that the larger electrode you can use the better. In this electrode the sponge is about five inches in diameter, and can be removed and replaced at will. It was originally designed by me for use in general faradization, but it proved so useful, and I found that it enabled me to get through my work so quickly, that I have since made use of it in every case where I possibly could. A description of it was published in the *Lancet* of 1889, ii., p. 270.

2. *A Flat Sponge about three inches in diameter* enclosed in a cup of vulcanite. This is a modification of the late Dr. Stevenson's electrode, and is made larger than those sold under that name at the shops. Its great advantage lies in the fact that its turned-up edge will catch the drippings from the sponge. This enables it to be used under the patient's clothes without wetting them, a most important point in practice. I am in the habit of employing this as my fixed electrode, applied, as I shall show later on, to the epigastrium or the sacrum.

3. *A Flat Sponge-covered Electrode about two-and-a-half by one-and-a-quarter inches*, fitted on a good firm handle. This is used for applications to the sympathetic in the neck, and to the trunks of nerves.

4. *A Flat Flexible Metal Electrode, covered with Flannel, and measuring eighteen inches by three inches.*—This is used for stable applications to the spinal cord, and must be furnished with several pairs of tapes, sewn to its edges at equal distances, to tie round the body, and thus secure it during use.

5. *A Wire-Brush Electrode, for use in general Faradization.*

6. *Cap Electrode, for applying the Electricity to the Brain.*—This is made of quilted flannel, containing crushed lumps of carbon between its layers, and being constructed on the plan of Apostoli's abdominal pad, allows a large quantity of electricity to pass though the brain without any unpleasant sensations.

7. *An Electrode for Faradizing the Interior of the Stomach.*—This consists of an ordinary red rubber stomach-tube, perforated with several holes at the end instead of the usual lateral eyes. Down its lumen passes a flexible metallic cord, terminating in a metal rod, with rounded end of an inch in length, and of such a diameter as to completely fill the bore of the tube.

These electrodes must be provided with screw terminals to fit the ends of the conducting cords.

All the apparatus that I have enumerated can be procured of any good English maker. The reader will have probably noticed that I advocate sponge-covered electrodes, while most of the books recommend the use of flannel-covered ones. I have arrived at the conclusion, after a good many experiments, that sponge is much the best for labile applications—that is, in cases where the electrode has to be moved about, and that flannel is the best for use in stabile ones, where the electrodes remain stationary. I am sure that if the reader will make the trial himself, he will agree with me that sponge has the following advantages :

It runs easier over the surface of the body.

It is more agreeable to the patient.

It is easier to keep clean.

And lastly, but not least, it acts as a regulator to the strength of the current. By commencing the application with it hardly touching the skin, and by gradually increasing the pressure, the current is applied at first so weak as to be almost imperceptible to the patient, although a considerable number of cells may be in circuit.

As you increase the pressure on the sponge, more of the current will pass.

The explanation of this apparent paradox lies in the fact that capillary action draws the water into the interior of the sponge, leaving the surface comparatively dry. In this state its surface is not such a good conductor as it would be if it were wet. As you apply pressure to the sponge, you force the water to the circumference, and thus increase its conducting power, and consequently the quantity of electricity that enters the body of the patient.

The methods of using galvanism in the treatment of affections of the stomach are :

1. Central galvanization.
2. General faradization.
3. Local faradization of the stomach.

I shall first describe in detail the manipulations required for each kind of application, and shall then briefly indicate the affections of the stomach in which they are likely to respectively be of service.

Central Galvanization.—This is the analogue of general faradization, and is perhaps the most useful and generally applicable method of applying the galvanic current in neurasthenia. In general faradization we bring under the influence of the *faradic current* in succession most of the muscular and cutaneous structures of the body. In central galvanization we likewise bring under the influence of the *galvanic current* the nerve centres.

This mode of applying electricity, besides being of extreme value, is a much more convenient method than general faradization. In fact, I now practically confine myself to the use of this method in the great majority of the sufferers from neurasthenia that come to consult me. Its convenience resides in the fact that the duration of time occupied in application is very short, and that it is not absolutely necessary for the subject to undress.

This, I need not remark, is of special advantage in the case of lady patients. All that is required is to loosen the stays, when the necessary application can be made to the spine with the greatest ease.

In this method of application, save in exceptional cases, the negative pole is used for the indifferent electrode, and is applied to the epigastrium. Dr. Stevenson's cup electrode, already described as modified by myself, is undoubtedly the best, as there is no danger of wetting the garments of the patient. If the patient is stripped to the waist, he holds the electrode in position himself, but if you are operating on a lady, the pressure of her clothes will be sufficient to keep it in position, as they are only loosened. As regards the positive pole let this be your rule—always use as large an electrode as you can. In operating on a man you can make use of my large sponge electrode for the whole application; but if you are applying the current to a female you will only be able to use it to her head and neck. For the application to the spine you will have to make use of a long-handled electrode.

And here I would mention that, in applying the continuous current to the head and neck, it is absolutely necessary that, in addition to the dial collector, you have a rheostat interposed in the circuit. The reason of this is that with the best constructed dial collector it is quite impossible to avoid a slight shock when a fresh cell is turned on, even though the collector puts them on one at a time. Whenever a current is increased at a bound, however small, as must occur on switching on another cell, an extra current is induced in the wire. When you increase the current it is in the opposite direction, and when you diminish the current it is in the same direction as the current that is already passing along the wire. This infallibly causes a shock, which is certainly very slight, yet will often be perceived by a

sensitive patient when applied to the head or neck, and may give rise to a flash of light or other disagreeable sensation, which will in all probability alarm him, and should for that reason be carefully avoided.

Well, these preliminaries having been arranged, we proceed to apply the current to our patient. The negative pole is placed, as we have seen, at the epigastrium. Now the positive pole is placed on the forehead. With the left hand turn the milled head of the rheostat, watching the galvanometer all the time, until the index shows that one milliamperè of electricity is passing through the body of the patient. Now pass the electrode very slowly from one side of the forehead to the other, and then over the centre of the head to the top, remaining there on the cranial centre for about a minute. Whilst the electrode remains stationary in this position, gradually turn the screw of the rheostat until the galvanometer registers two milliamperès. If, however, the patient experiences a sour or metallic taste in the mouth, it shows that too much galvanism is passing, and the current should be again reduced until this becomes just imperceptible. You must carefully remember that the correct strength of current to pass through the head is one that will not give rise to this sensation, and yet if increased ever so little will cause it to become apparent.

The current is now to be applied to the pneumogastric and sympathetic nerves in the neck, and this is done by carrying the electrode up and down the inner border of the sterno-mastoid muscles from just below the angle of the jaw to the intra-clavicular fossa. This application should be continued for from one to five minutes. You can now finish the application by galvanizing the spine, first taking care to change the electrode for a long-handled one if the patient is not stripped to the waist. The electrode is passed

slowly up and down the spine, paying special attention to the cilio-spinal centre, as you do in applying general faradization. As the back is not so sensitive to the current, you may use from five to fifteen milliampères, and treat the part for from three to ten minutes.

The total duration of the whole process should not exceed five minutes on commencing a course of treatment, and should be gradually increased from day to day, until the séance lasts for twenty minutes during the last week or so.

Instead of the 'labile' method here described, 'stabile' applications to the spinal cord are sometimes to be preferred. In these cases you bind the long spinal electrode over the spines of the vertebra by the tapes fastened to its edges, and having connected it with the pole you wish to apply, you attach the other to the cup electrode, held on the sternum in the usual manner. You leave it applied there for a period varying from three to twenty minutes, according to circumstances.

Galvanization of the brain is also useful in some cases, and is a process which has in my hands produced the most favourable results in the treatment of neurasthenia.

The hair being thoroughly wet, a light cap of flannel is applied to the head. This cap is double, and between the layers are quilted a number of small pieces of gas carbon. This cap is attached to the positive pole of the galvanic battery, while the ordinary cup electrode is applied to the pit of the stomach. Keeping these *in situ*, a current is passed beginning at two to three milliampères. This is increased gradually from day to day both as to the current strength and the length of the séance, until we arrive at the end of two or three weeks at a current strength of fifteen to twenty milliamperes passed for ten minutes. The wide area that this helmet-electrode covers lessens by just so much the resistance to be overcome, and enables us to pass

through the head a current of greater strength without pain or ill result.

It is necessary, however, to include a rheostat in the circuit, so that the increments of current may be made in such a gradual manner as not to produce flashes of light or other unpleasant sensations.

General Faradization.—This, as its name implies, consists of the application to the body of the interrupted or faradic current. It is by no means as easy to apply as it would appear from reading a brief description of the process. As Beard and Rockwell remark in their classical treatise on ‘*Medical and Surgical Uses of Electricity*:’ ‘Its successful employment requires, on the part of the operator, some mechanical dexterity; entire familiarity with the instruments required; a complete knowledge of electro-therapeutical anatomy; a personal acquaintance with the sensations and behaviour of all portions of the body under the different electric currents; close and patient study of the diseases and morbid conditions in which it is indicated, and of their response to faradization.’

The electrodes I use for this method in most cases are the cup electrode, and the large wooden sponge-holder.

The patient seated in a chair, and stripped from the waist upwards, the cup electrode is fastened over the sacrum by a band of webbing having a slit in it to receive the knob of the electrode, and fastened in front by a buckle. The large sponge electrode is fastened to the other rheophore, and taken in the right hand of the operator. The faradic apparatus should be at a convenient distance from the operator, so that the sliding coil and the draw tube can be controlled by his left hand.

It was formerly the custom to moisten the electrodes

used with salt and water, but experience has taught us that a far preferable liquid is water rendered slightly acid by a little vinegar. This does not tarnish the metal work nor crystallize in the interstices of the sponge as salt does, and is found in practice to be quite as good a conductor.

Up to this time the current is not turned on, and the battery is not in operation. The sponge should now be placed on the patient's forehead. The two sliding coils of the machine being drawn quite apart, if you are using a sledge coil, or, if one of the ordinary pattern, the helix drawn quite out, the current is turned on and the coil put in operation. Keeping the sponge quite steady, the coils are moved toward each other, or the helix pushed in, until the current is just perceptible to the patient.

Keep the sponge where it is for about twenty seconds, and then move it slowly along the middle line towards the occiput, keeping up a gentle pressure all the time. On reaching the occiput keep the sponge there for about five seconds, at the same time with the left hand pushing the helix a little further in, and thus increasing the current strength. Now move the sponge from side to side over the regions behind the ears, and on each side of the neck, at the same time gradually increasing the current. Keep the sponge where it is over the seventh cervical vertebra for about ten seconds more. This spot at the back of the neck is one of the most important points, as it is what is called the cilio-spinal centre, and a current applied here is communicated not only to the spine, but also to the larynx through the laryngeal nerves, to the stomach by means of the pneumogastric, to the lungs by the phrenic, to the sympathetic, and to the hands and arms by means of the brachial plexus of nerves. One must be careful at first, however, not to use too strong a current, as many patients will cough

spasmodically, owing to the irritation of the laryngeal nerve, and experience a metallic taste in the mouth from excitation of the gustatory branches of the glossopharyngeal.

The sponge should now be passed over the posterior triangle of the neck, making an application of about five seconds on each side. It is an important point to remember that the distribution of the pneumogastric on the two sides varies, that on the left side going mainly to the stomach, and that on the right side to the intestines. Therefore, in practice, when we wish to remedy a state of atony of the stomach giving rise to dilatation, we should pay particular attention to the left side, and when we are treating a state of constipation, we should apply the current for a longer period to the right side.

The sponge should now be passed slowly up and down the spine, which will bear a far stronger current. This application to the spine should be continued for four minutes. The electrodes should now be applied in the same manner for three minutes over the surface of the abdomen, and about two minutes over the arms. The patient should at this juncture put on some of his upper garments, and clothe his lower extremities; the boots, however, need rarely be removed. The sponge must now be carried over the surface of the legs for about three minutes, going once only slowly over the lower extremities. This finishes the application.

In cases where an extremely stimulating effect is desired, the electric brush can be used to the spine, either in addition to, or in alternation with, the method of application here described. In using it, the skin must be well dried, and preferably slightly powdered. A current must be used strong enough to just produce sparks between the skin and the wires of the brush. A current stronger than this is unnecessary.

Faradization of the Stomach.—There are two methods of carrying out this :

1. By external electrodes. One large flat electrode is placed over the stomach, and the other upon some indifferent part, the buttocks for preference ; or two smaller electrodes may both be placed at a couple of inches apart upon the stomach region. The former is, I think, the best method, and the one which I invariably adopt. Each of the electrodes respectively is attached to one of the poles of the coil. It appears to be immaterial which pole is used. The coil must be a specially prepared one wound with thicker wire than usual, and slow interruptions are essential.

2. By an external and internal electrode. For the external one, the large flat electrode used in the first method is employed. The internal electrode is the rubber tube already mentioned. The patient swallows a glass of water, and the tube is passed in the usual manner. In this application it is best to use a coil wound with as fine wire as possible, and with a contact-breaker interrupting the current as rapidly as possible, and giving a fine smooth current.

Indications for Electricity.—There is a great deal of clinical evidence available to prove that the use of electricity gives really good results in certain affections of the stomach. It can be used with advantage for the following purposes :

1. *In cases of atony of the stomach-walls*, to restore tone to the muscular structures. It is here used with the same idea as in ordinary paralysis of limbs. Local faradization of the stomach both internally and externally is the method to be adopted. It may be combined with faradic brushing of the abdominal walls. If due to neurasthenia, we must use in addition the continuous current.

2. *Gastric Neurasthenia.*—Here we shall use central

galvanization. If this is attended by atony of the stomach-walls, or by anachlorhydria, we may employ local faradization in addition.

3. *Constipation*.—Galvanization of the sympathetic in the neck, together with faradization of abdomen with coil giving coarse interruptions, will give good results.

In cases of general neurasthenia, general faradization may be alternated with the central galvanization.

My own experience of the use of electricity in the treatment of gastric neurasthenia has been most gratifying. It has repeatedly happened to me to be able by this means to restore to health cases which have resisted all other methods of treatment. I can unhesitatingly affirm that if I were limited to one means of treatment, if I were compelled to choose between treatment by drugs, diet, or electricity respectively, electricity is the agent which I should select. In combination with the others it more often than not gives results which are really brilliant. I have found that gastralgia is relieved, appetite is increased, atony of the stomach walls removed, and the normal quantity and quality of gastric secretions re-established, in very many cases. The other distressing sensations from which the patient suffers also usually disappear during treatment, insomuch as the improvement must always be the result of the beneficial effects of the electricity upon the general neurasthenic condition.

MASSAGE.

As an accessory means of improving the general condition of the patient, massage has occasionally proved itself useful in my hands. A dilated stomach due to stenosis of the pylorus may often be almost emptied into the duodenum by proper manipulation. This method of treatment finds its chief use in the treatment of constipation, general neurasthenia, and atony of the stomach. In constipation especially, used in com-

bination with faradization of the abdominal walls and special exercises to strengthen the abdominal muscles, it often gives brilliant results. In using massage we must exercise caution, and take care not to expel acrid and undigested masses of food into the duodenum, or we may set up irritative diarrhœa.

DRUGS.

We may almost say that the treatment by medicinal agents of affections of the stomach virtually resolves itself into an intelligent and scientific manipulation of hydrochloric acid and bicarbonate of soda, assisted by the use of strychnia and other bitters, and certain sedatives, bismuth, and antiseptics. We also make use of certain agents which have a topical action upon the stomach, such as nitrate of silver, and others which act as direct tonics to the nervous system. Alcohol should likewise be regarded as a medicinal agent. We shall briefly consider the drugs which have been thus found useful in alphabetical order, noting as far as possible the indications calling for their respective administration.

Alcohol.—This must, I think, be regarded as a medicinal agent rather than as a food accessory, as it is of undoubted value in the treatment of gastric diseases. It is now a well-recognised fact that alcohol is an important stimulant of the process of stomach digestion, and it is not unlikely that most of the much-recommended tinctures and elixirs and ‘bitters,’ with more or less elaborate names, really owe their action to the alcohol that they contain.

As far back as 1760 and 1846, investigators, such as Gosse and Frerichs, had arrived at the conclusion that alcohol promoted the secretion of gastric juice, but later experiments with artificial digestive processes (in the laboratory) appeared to negative this conclusion.

It was found that when alcohol was added to a meat solution, digesting in a beaker over a water-bath, a delay was effected in the process. This varied from a slight slowing to an entire cessation of the process, according to the quantity added. And it was therefore erroneously concluded that the same held good of digestion in the human stomach.

But later and more careful researches have demonstrated beyond a doubt that such is not the case.

The fact has been established that alcohol, when taken into the stomach along with the food, has two periods or phases of action.

During the first of these the digestion of albumin is impeded. But after the alcohol has been absorbed a second stage ensues, in which the secretion of HCl increases to two or three times the amount which would otherwise be the case. And this increase varies up to a certain point directly with the amount of alcohol taken. After the stomach-digestion is completed, the secretion of HCl also continues longer than in cases where no alcohol has been taken. This, however, only holds good for the normal healthy stomach. *Alcohol does not have this stimulating effect in pathological conditions where the HCl is either diminished or increased in amount.*

Alcohol also appears to have the power of increasing the peristaltic movements of the stomach.

This latter fact agrees with the results of my own observations. I have often found that cases of extreme flatulence, with temporary distension of the stomach coming on at a time when stomach-digestion ought to have been completed, and evidently due to abnormal retention of food, were promptly relieved by a dose of alcohol, generally *without* any eructation of gas to speak of. In these cases I have determined in several instances, by percussion, that the stomach was filled with solid and fluid materials rather than

with gas. And I have always explained the relief on the hypothesis that the alcohol stimulated the stomach to contract, and to expel its offending contents into the duodenum.

We may, I think, come to the conclusion—

1. That alcohol, in moderate doses *with meals*, is harmless, or even beneficial, to healthy people.

2. That it is decidedly beneficial in cases of indigestion where the motor power of the stomach is impaired, such as gastric neurasthenia.

3. That it is contra-indicated where profound alterations exist in the quantity of HCl, unless there are other indications present for its administration.

Antiseptics.—These are used to disinfect the contents of the stomach and intestines and prevent the growth of micro-organisms.

We must, for clinical purposes, divide antiseptics into two groups—those which are to act in the stomach, and those which we intend to influence the intestinal contents.

Of the agents which we have at our command to prevent abnormal fermentation in the stomach, hydrochloric acid is undoubtedly the most valuable. All fermentation is impossible when the stomach contents contain 4 parts per 1,000 of commercial pure acid. As much as a pint of such a solution may be given if necessary during the twenty-four hours in divided doses. The mistake is usually made of giving far too small a dose. The other antiseptics which are useful are iodoform, chloroform water, peroxide of hydrogen, and sulphocarbolate of sodium. Sodium sulphocarbolate may be given in doses of 10 to 15 grains directly before or after meals.

Intestinal antiseptics, to act efficiently, must be insoluble. They must be able to pass along the alimentary canal without being absorbed. Those in most general use are salol, charcoal, salicylate of bismuth, iodoform,

and naphthalin. Bouchard employs a mixture of some of these for the purpose of producing intestinal antiseptis in cases of typhoid fever. It is composed as follows: 100 grammes of powdered vegetable charcoal are mixed with 1 gramme of iodoform and 5 grammes of naphthalin. To this mixture is added 200 grammes of glycerin and 50 grammes of peptone (estimated as dry peptone). The dose is one tablespoonful every two hours in a third of a tumbler of water. For use as an ordinary intestinal antiseptic the peptone might be omitted.

Aromatics, Antispasmodics, and Carminatives.—These are used for the relief of flatulence, and to remove uneasy sensations. They appear to stimulate the nerves of the stomach and enhance the activity of the gastric circulation, at the same time increasing the peristaltic movements and relaxing the cardiac orifice. The result is eructation of wind and the relief of cramps and spasms.

Asafoetida, ammoniacum, valerian, camphor, oil of chamomile, oil of rue, are the most used. Mustard, horseradish, and capsicum, also act in a similar manner.

Arsenic.—This drug is of great value in small doses in irritable conditions of the stomach. It acts upon the mucous membrane and stimulates the vessels and nerves. It thus increases appetite to a marked degree. In so-called ‘irritative dyspepsia,’ where the symptoms of indigestion are associated with a furred tongue with red and prominent papillæ, small doses of arsenic do a great deal of good. It will also, according to some writers, stop the morning vomiting of drunkards; but in my own hands I have found greater benefit from papain, given in the morning on an empty stomach before rising, and followed by a tumbler of hot water.

In addition to its local action, arsenic is one of the most important nerve tonics which we possess. It is especially useful in gastric neurasthenia. It probably acts by increasing the vital activity or metabolism of the

body generally. It acts upon the nervous system by diminishing hypersensibility and reflex activity. It has been stated by some writers to have an elective affinity for the pneumogastric nerve. There is nothing inherently improbable in such a hypothesis, insomuch as many drugs with which we are well acquainted certainly evince predilections for certain organs and tissues.

Asafoetida.—This drug is of great value in gastric neurasthenia occurring in women about the menopause. It gives in many cases relief to the intestinal flatulence, and keeps the bowels open.

Bismuth.—The subnitrate and the carbonate, when taken internally, exercise a powerful sedative action upon the stomach. They are used for the relief of pain and vomiting, and also in reflex or nervous sickness. Bismuth must be given in doses of 20 grains or upwards to do any good, and is usually combined with bicarbonate of soda and hydrocyanic acid or opium. A little mucilage is also generally added to suspend it.

Salicylate of bismuth is one of the best agents for inducing intestinal antiseptis.

A subgallate of bismuth, to which the trade name of 'Dermatol' has been applied, is exceedingly useful in certain forms of diarrhoea, and is coming into extensive use.

Bitters (Pure Vegetable), such as quassia, gentian, rhubarb, hop.—These from time immemorial have been supposed to stimulate the appetite, and they apparently do so. But from the investigations of many competent observers, it appears that this is not the result of any local action upon the stomach, modifying in any way the secretion of gastric juice, but is a purely nervous phenomenon.

The nerve terminals, being irritated, stimulate reflexly the hunger centre in the brain.

Bicarbonate of Soda.—This is administered in dyspepsia

in two different ways to produce two distinct and, we may almost say, opposite effects :

1. In large doses (grs. xxx. to $\mathfrak{z}\text{i}$.), taken some time after meals, it is used to neutralize the contents of the stomach when too acid.

2. In small doses (grs. v. to grs. xv.), taken shortly before a meal, it will increase the flow of acid gastric juice.

The latest investigations upon the subject are those of Linossier and Lemoine,* who had the opportunity of experimenting with a patient having the power of ruminating at will. They gave him test meals of beef, bread, and water. The conclusions that they have arrived at are as follows :

1. Sodium bicarbonate in all doses increases the gastric secretion.

2. With small doses, the excitation continues after the excess of alkali has been neutralized by the HCl, and consequently the chyme becomes richer in that substance.

3. With medium doses the excitement is still more prolonged, the maximum of HCl appearing later and being much higher.

4. With large doses such as 150 grains, the secretory power of the stomach is exhausted by its attempts to neutralize the existing alkalinity, and the chyme leaves the stomach with less than normal acidity, the secretion of HCl stopping almost as soon as the alkali has been completely neutralized.

5. The maximum of HCl occurs two hours after a dose of $7\frac{1}{2}$ grains, three hours after a dose of 15 grains, and four hours after a dose of 75 grains.

6. The presence of sodium carbonate favours the production of the acids of fermentation.

7. The exciting action of sodium bicarbonate is greatest and most prolonged when given in doses of 75 grains

* "Mémoires Originaux," 1893, p. 665, and *Med. Chron.*, xix., p. 181.

one hour before a meal. A dose of 15 grains is too small, and one of 150 grains is too large.

8. Given just at the beginning of a meal, sodium bicarbonate suspends the secretion of pepsin.

9. Given one hour after a meal, 30 grains only momentarily affects the acidity, and is not followed by excitation; 75 grains suspends digestion for a time, but an hour afterwards there is moderate acidity; 150 grains suspends digestion, but in another hour enough fresh HCl has been secreted to neutralize all the sodium bicarbonate, although in the effort to do so the mucosa appears to become so exhausted that the normal acidity is not regained.

10. Salts of calcium act practically like sodium salts; but though the amount of acid produced is the same, yet there is less of it present in the free state, and consequently theoretically we should expect it to be preferable to sodium bicarbonate in the treatment of hyperchlorhydria.

11. The action of sodium bicarbonate is not confined to the day on which it is given; the secretory activity caused by it continues for some days longer.

It would seem as if the gastric mucous membrane always endeavoured to maintain a definite percentage of acidity in the fluid in contact with it. If sodium bicarbonate be given, the glands at once set to work to secrete HCl; and if the latter be given, they cease secreting acid. This may possibly explain the success that has attended the treatment of gastric ulcer with hydrochloric acid.

How these facts upset our preconceived notions is apparent when we reflect that we are taught in the classics to give hydrochloric acid after a meal if we imagine that there is deficiency in the amount of acid in the gastric juice, and to give a single moderate dose of an alkali to neutralize any excess in that direction.

Alkalies in neutralizing quantities are indicated in cases where the HCl secretion in the stomach is in excess. They are of advantage, both by protecting the mucous membrane of the stomach from the irritating action of the acid, and by neutralizing the excess of HCl present in the stomach. They thus enable the salivary ferment to again become active.

They also prevent the too great acidity of the chyme as it enters the duodenum from interfering with the proper action of the bile and pancreatic juice.

It is a fact to be remembered, that the continual administration of alkalies appears to diminish the constipation which is present in these affections of the stomach. They probably effect this both by the improved digestion which ensues, and also by limiting the inhibitory action of the HCl upon the peristaltic movements of the stomach and intestines. Bicarbonate of soda also certainly increases the secretion of bile.

Some authorities imagine that, for purely neutralizing purposes, chalk and carbonate of magnesia are superior to bicarbonate of soda; $3\frac{1}{2}$ grains of the former and $2\frac{1}{2}$ of the latter together equalling in their action 10 grains of bicarbonate of soda.

I give my reasons for disagreeing with this proposition on p. 267.

Besides the bicarbonate of soda, already considered, we have in constant use—

Liquor potassæ.

Bicarbonate of potash.

Carbonate of ammonia.

Aromatic spirits of ammonia.

Magnesia.

Carbonate of magnesia.

Solution of carbonate of magnesia.

Lime-water.

Saccharated solution of lime.

Chalk.

For purely neutralizing purposes, the bicarbonates are to be preferred to liquor potassæ, as their action is milder and longer continued. Magnesia is useful when the bowels are confined, and lime-water if they are relaxed. Liquor potassæ is, moreover, a sedative to the stomach, and may be employed if there is much pain.

Ammonia, either in the form of the carbonate or of the aromatic spirit, is especially indicated when there is want of tone in the stomach and duodenum. It allays spasmodic action, and tones up the relaxed mucous membrane. It is especially useful in the irritable stomachs of chronic alcoholics, when given in an effervescing form. It is important to remember that ammonia must not be given for too prolonged a period, as it is apt to excite catarrh of the stomach and intestines.

Magnesia and carbonate of magnesia are sometimes to be preferred to the bicarbonate of soda, lime, or potash, because—

1. They have a larger saturating capacity for acid.
2. They are purgative.
3. They are harmless when given in excess on account of their insolubility.

The great disadvantage of these substances is their bulk. As an antacid, magnesia is to be preferred to the carbonate, as the latter gives off so much gas that the stomach may become disagreeably distended.

Generally, other agents of this class are to be preferred to the preparations of lime. Lime-water is chiefly used as an addition to milk, given to children to prevent the formation of too thick a clot of casein. It is also very useful in chronic vomiting and diarrhœa in young children.

Cannabis Indica.—This is a drug which is of very great value in the treatment of dyspepsia, and has not received the attention which it merits. In my hands it has proved exceedingly useful, especially in cases depending upon

defective innervation. It is a sedative tonic which improves the appetite without producing constipation. Its reputation for untrustworthiness and unreliability is entirely undeserved, if proper care be taken in the pharmaceutical preparation of the drug.

I believe it to be a true gastric sedative, without the disadvantages of bismuth, bromides, or antipyrin. I give it in the following conditions :

Inorganic affections, including chemical changes in the gastric juice, especially neuroses, even if accompanied by variations in the composition of the gastric juice.

I find it useful in painful sensations, localized or not, either occurring spontaneously or set up by contact of food with the walls of the stomach ; pyrosis, vertigo, migraine, insomnia, somnolence, palpitation, and oppression.

It may be given in doses of 5 to 10 min. of the B.P. tincture, or better still in doses of $\frac{1}{5}$ of a grain of the solid extract.

Charcoal.—This substance was introduced into the practice of medicine for the treatment of flatulence because it was known that charcoal possessed the power of absorbing many times its bulk of gas. But the fact was overlooked that this is only true of *dry* charcoal. Wet charcoal has no such action. Nevertheless, it is employed with great success in many diseases of the stomach, and is of marked use in certain forms of flatulence. It probably acts by arresting fermentation. But I think that we must concede to it a dynamic action of some kind upon the organism, as I have myself on many occasions seen very small doses relieve very extreme degrees of flatulence. It is a curious fact that the kind of flatulence relieved by charcoal is *probably not due to fermentation*, as the gas is generated in enormous quantities very soon after eating, and 5 or 10 grains of vegetable charcoal will often give speedy relief.

In considerable doses charcoal is very useful in producing intestinal antiseptis. It fixes the toxic matter of the fæces, the colouring matter, and alkaloids, and prevents them from entering the urine.

Creasote.—Creasote has long been used by practitioners in derangements of the stomach, and was usually prescribed under the idea that it had an antiseptic action. It is now known that it both stimulates the peristaltic action of the gastro-intestinal canal and increases the secretion of gastric juice. Indeed, Klemperer attempts to explain its undoubted beneficial effect in cases of phthisis upon this hypothesis alone, rather than upon any anti-bacillary action that it may exert in that complaint.

It is most conveniently given either dissolved in wine or in capsules.

Bouchard's formula is as follows :

R Creasoti	-	-	-	13·5
Tinc. Gentian.	-	-	-	20
Vin. Xerici	-	-	-	800
Sp. Vini	-	-	-	200
Misce.				

The dose of this will vary with the quantity of creasote which we wish to give. It is usual to commence with 1 or 2 min. doses. I have taken the liberty of altering this formula so that it will form a 1 per cent. solution. The required dose of creasote can then be easily prescribed.

My formula is :

R Creasoti	-	-	-	10
Tinc. Gentian.	-	-	-	20
Vin. Xerici	-	-	-	800
Sp. Vini	-	-	-	170
Misce.				

For out-patients creasote may be prescribed simply dissolved in Tinc. Gentian. Co. B.P.

Hydrastis Canadensis.—This bitter tonic depends for its action upon two active principles, berberine and the alkaloid hydrastina. It is an undoubted stomachic tonic, and is much more used in America than in this country. It appears to exercise a specific action upon the mucous membranes, checking any abnormal discharges from them.

In the form of the tincture, it is of the greatest value in the treatment both of chronic gastritis and gastric neurasthenia. It is exceedingly useful in the chronic stomach catarrh of alcoholism, and is perhaps the best aid which we have to enable a man to give up alcohol, as it almost immediately relieves the distressing sensation of sinking and 'all-gone-ness' at the epigastrium so frequently experienced.

It is also extremely useful in the atonic form of gastric neurasthenia, especially when associated with constipation, as it has a direct stimulating action on the liver.

Its concentration, hydrastin, which consists principally of the hydrochlorate of berberine with extractive matters, has almost the same action, and furnishes a very convenient way of prescribing the drug, as it may be given in pill form (2 to 6 grains), thus enabling the patient to avoid the rather nauseous taste of the medicine.

Dilute Hydrochloric Acid.—This acid is administered in affections of the stomach for two purposes :

1. As a stimulant to the secretion of gastric juice.
2. As an antiseptic, to limit the fermentative processes in the stomach.

As we have seen, the digestive proenzymes (pepsinogen, etc.) are not converted into active agents until they come in contact with HCl. When, therefore, we have reason to suppose that these are in normal quantity, and that the HCl in the stomach alone is deficient,

we should give the acid. In many cases HCl appears to cause an increased flow of normal gastric juice by direct stimulation.

As an antiseptic, it is given when the first stage of the digestive process is unduly prolonged, to prevent the secondary fermentations from taking place in the stomach.

Hydrocyanic Acid.—The dilute hydrocyanic acid is a direct sedative to the mucous membrane of the stomach, and is chiefly used to check vomiting. For this purpose it is usually prescribed either in an effervescing mixture, or in combination with bismuth, soda and morphia.

Ipecacuanha. — Whilst large doses taken into the stomach act as a direct irritant, and produce vomiting, smaller quantities apparently merely act as a stimulant, increasing the secretion of mucus. It is therefore of use in chronic gastritis.

It will often check the following kinds of vomiting when given in doses of one minim :

1. The vomiting of pregnancy.
2. The vomiting which occasionally occurs during suckling.
3. The vomiting occurring in connection with the menstrual period (either before, during, or after).
4. The morning vomiting of drunkards.
5. The morning vomiting which sometimes accompanies general weakness or convalescence from acute diseases.
6. Vomiting in children with acute stomach catarrh.
7. The vomiting which is occasioned in whooping-cough by the violence of the cough itself.
8. Vomiting occurring after food without nausea or pain.

The action of ipecacuanha upon the stomach is specific, since it will act upon it through whatever channel it has entered the system. It always produces vomiting *through* the stomach reflexly. If the pneumogastrics be divided,

so that their gastric extremities are paralyzed, ipecacuanha cannot produce vomiting.

Nitrate of Silver.—When given in solution, a certain proportion is changed into albuminate as it is taken into the mouth, and what remains enters the stomach. The same thing takes place here, and it is only the balance that has been unacted on that has any effect upon the coats of the stomach.

Its specific action upon the stomach is that of an irritant, something like arsenic. In small doses it will check the pain of chronic catarrh, of chronic ulcer, and even of cancer. In these two latter cases it probably acts in the same way that it does in checking pain on other mucous surfaces; it deadens pain by coagulating the superficial layer, and thus rendering it more difficult for the nerve terminals to receive painful impressions.

When it has been absorbed into the system it acts as a tonic to the nervous system. It is thus occasionally useful in gastric neurasthenia. As a tonic the oxide is to be preferred.

Nitro-hydrochloric Acid.—This acid is chiefly useful as a hepatic stimulant. Clinical experience has long held it to be such, and the experiments of Rutherford on dogs confirmed the fact.

It is a most valuable medicine in the form of chronic gastritis so frequently met with in strumous children—children with thin skins and fine hair, with delicate complexions, whose stomachs get out of order on the slightest provocation. In these cases it is best given combined with taraxacum.

In adults it is indicated in cases where there is mental despondency, oxalates in the urine, sallow complexion, and eructations of offensive gas.

Orexin.—Where anorexia is the only prominent symptom, a new drug, hydrochlorate of orexin, has been strongly recommended by Penzoldt. Experiments made

by Hofmann and Munter showed that 15 grains could be given for a dose without any untoward effect. When a dose of $7\frac{1}{2}$ grains was given a strong feeling of hunger was produced. As the result of the examination of the stomach contents after a test meal, it was found that the free hydrochloric acid appeared in the stomach in from half to one hour sooner than when the drug was not taken, and that digestion was accelerated by that amount of time. In subsequent experiments upon thirty-six patients suffering from anæmia, tuberculosis, gastric catarrh, etc., the appetite was greatly increased in all but five, and several phthisical patients gained in weight whilst taking it. It was given in doses of 5 to 7 grains once or twice a day in capsules, a cup of beef-tea being given at the same time.

Boas confirms these observations in the main, but expresses his opinion that a larger number of cases must be treated, and a more accurate clinical differentiation of their precise conditions must be made before we can arrive at any definite opinions as to its exact sphere of action. This is all the more essential, seeing upon how many different conditions loss of appetite may depend, and the improbability that orexin will prove equally beneficial in all of them.

Sialagogues.—We have pointed out that the presence of alkaline saliva in the stomach is an important factor in determining the flow of gastric juice. It is therefore evident that sialagogues can very materially assist digestion. The normal sialagogue is the reflex irritation caused by the mastication of food in the mouth. This we assist by pungent and aromatic additions to our food. It is an important point to remember, that we must not allow the food we give our patients to be *too* bland and unirritating.

All bitters, especially *nux vomica*, and stimulating substances, like ginger and cayenne, increase the flow of

saliva. Sialagogues are also useful to indirectly correct undue acidity of the stomach. The proper flow of alkaline saliva will gradually neutralize the excess of acid, and render the patient much more comfortable. For this reason we may with advantage treat acid dyspeptics with lozenges containing stimulants to the salivary flow, in preference to using antacids.

Strychnia and Nux Vomica.—These agents are, without doubt, among our most valuable weapons in the management of diseases of the stomach.

1. Like other bitters, they stimulate the hunger centre.

2. They increase the flow of saliva.

3. They give tone to the muscular walls of the alimentary canal, and increase the frequency and extent of the peristaltic movements. They are thus useful in constipation.

4. They act in some unknown manner through the nervous system in removing a certain group of symptoms, viz., furred tongue, weight at the pit of the stomach, flatulence, heartburn, and vertical headache.

Strychnia also has the action of removing, to a great extent, the craving for drink in chronic alcoholics.

Strychnia and galvanism are our two main agents in curing temporary dilatation of the stomach, the result of atony of its walls.

Taraxacum is at once a simple bitter, a cholagogue, and a mild laxative.

To be of any use it must be given in much larger doses than is recommended in the text-books. From a half to a tablespoonful of the succus is not any too much, and will give good results when smaller doses are quite useless.

Valerian.—In the forms of valerianate of soda and valerianate of zinc, this drug is of great use in the treatment of gastric neurasthenia. It is a significant fact that,

although in books little value is attached to this agent, yet the more experience a medical man has in the treatment of these cases, the more important a place do valerian and its salts assume in his armamentarium. With this drug alone, I have no hesitation in affirming, can be cured inveterate cases of dyspepsia in overworked city or literary men, cases where all ordinary remedies have been fruitlessly tried, and where the diet has been cut down to a minimum without good result.

Medicinal Treatment of Acute Gastritis.—The first thing to do is to ascertain that the stomach is empty. If we suspect the presence of undigested food, an emetic should be administered. We may generally recognise this condition by the presence of nausea, cramp-like pain, faintness, and ineffectual attempts to vomit. If vomiting cannot be induced by a draught of lukewarm water aided by tickling the fauces; ipecacuanha wine, or infusion of chamomile, will be found to be the best emetic. At the same time a sharp purge will be beneficial, and may consist of 3 to 5 grains of calomel, followed by a black draught, or a dose of blue pill and colocynth, with a seidlitz powder the next morning. *But in any case neither the emetic nor the purge should be repeated.*

As regards further medicinal treatment, sedatives and antacids are indicated, bismuth being especially useful, and dilute hydrocyanic acid if vomiting is a troublesome symptom.

If there is much epigastric pain, hot poultices or fomentations should be applied to the epigastric region, and a subcutaneous injection of morphia administered; or the opiate may be added to the bismuth mixture.

If the disease is prolonged, the further treatment will be that of chronic gastritis.

Medicinal Treatment of Chronic Gastritis.—There are several indications for treatment in this affection. Un-

fortunately, they cannot always be met by drugs. They are as follows :

1. To excite the secretion of the gastric juice.

This we do by the exhibition of bitters, such as quassia, gentian, rhubarb, nux vomica, and condurango. Sodium bicarbonate is also given in small doses before a meal for the same purpose (see p. 248). Alcohol taken at meals in small doses will cause a distinct increase in the gastric secretion (see p. 243). So does creasote.

2. To increase the tonicity of the muscular walls of the stomach.

The agents which we possess capable of effecting this are strychnia or nux vomica, and the local application of the faradic current.

3. To remove mucus from the coats of the stomach.

This we can accomplish by saline solutions, such as Carlsbad water ; by digestive ferments, notably papain ; and by lavage.

4. To check abnormal fermentations in the stomach.

Whilst possessing many antiseptic substances which are capable of arresting fermentative process in the stomach, an ideal one yet remains to be discovered. There is, unfortunately, some drawback associated with each of those in common use. The most useful are β -naphthol, either alone or associated with magnesia and bicarbonate of soda ; creasote ; salicylate of soda ; salicylate of bismuth ; charcoal ; benzol-naphthol ; salol ; and resorcin. Dilute hydrochloric acid is also very useful for this purpose under certain circumstances.

5. To relieve pain.

To fulfil this indication, we depend upon sedatives, such as opium, belladonna, cocaine, chloral, and hydrocyanic acid, either alone or in combination with bismuth and alkalies.

Besides the systematic treatment of the gastritis, there will probably be some subsidiary troubles which

will require special treatment. Among these we may mention unusual anorexia, obstinate constipation, vomiting, or extreme flatulence. The medication for these must be conducted on general principles, meeting the special indications with the known resources which we possess.

It is in the treatment of chronic catarrh of the stomach that a course of purgative mineral waters, taken at a foreign spa, has been found to give such striking results, and is part of the routine treatment on the Continent.

In this country, although the same diseases which are thus so beneficially affected are to be found in equal abundance, yet this method of treatment has never hitherto gained any great ground, from the fact that we have no purgative mineral springs in England of any value, and that the great majority of patients cannot afford a long Continental holiday. It has often been pointed out that there is nothing magical in the locality where the spring is situated. It is the strict diet imposed on the patients, the regular exercise in the open air, and the systematic method of administering the water, that do the good. And we do not sufficiently realize that all the benefits which are to be obtained by a course at Kissingen or Carlsbad can be procured at home by a careful and scientific administration of imported waters.

To produce this valuable result, all we have to do is to imitate, as closely as possible, the essential conditions under which the waters are taken at the foreign watering-places.

In starting a patient on a course of purgative water, you must try and imitate the *essentials* of what his life would be at a foreign spa—that is to say, you must insist upon a sufficient amount of exercise in the fresh air, a diet which contains the minimum of saccharine and

fatty matters, and absence of worry and business cares to as great extent as possible.

But as a little concrete teaching is always worth more than a much larger amount of purely abstract consideration, we will take a supposititious case of a city man, who is suffering from lithæmia, or, as he would call it, 'torpor of the liver,' associated with chronic gastritis, and see what one day of his life would be, supposing that we were giving him a six weeks' course in imitation of that at Carlsbad.

He should rise at seven o'clock, and after having well rubbed himself down with a towel wrung out in warm water, finish off with brisk friction with a dry flesh-glove. Then after a ten minutes' spell with light dumb-bells or the pulley-weights, he should proceed to dress leisurely. Whilst he is doing so he will drink by sips a tumbler of hot Carlsbad water, containing as much of a stronger purgative water as he has found by experiment to be required to produce a single action of the bowels. By Carlsbad water, I mean that imported in stone bottles, which has not the purgative action of the so-called *Carlsbad salts*. Perhaps the Carlsbad alone will be enough. The water is brought to the required temperature by standing the vessel containing it in a basin of hot water.

After this a gentle walk of half an hour or so, and breakfast about 8.30. For this meal he may take a little white fish or an egg, cold meat or game, dry toast, *with very little butter*—but if he can be induced to forego the latter it will be better; weak tea or Schweitzer's cocoatina, sweetened with one of any reliable make of saccharin tabloids.

Lunch should consist of little more than a lean mutton chop or steak, with green vegetables, stale bread, and mashed potatoes. A little sound hock or table claret may be taken, or a little weak, well-diluted spirit.

Finishing his business not later than four or five o'clock, he should take exercise for at least an hour or an hour and a half in the open air, gently walking or riding, and dine about seven.

For dinner a clear soup, grilled or boiled fish, roast or boiled meat; plain-boiled green vegetables; stewed fruit, sweetened with saccharin; drink, the same as lunch.

The essential points in the diet are: To avoid almost entirely fat, sugar, and the stronger forms of alcohol, and to leave off eating *before the appetite is quite satisfied*.

After dinner, gentle recreation in the open air or a game of billiards.

Retire to rest early, after ten minutes at the dumb-bells or pulley-weights.

In my experience I have found that, from a course of treatment carried out in this manner, the patient will derive almost as much benefit as if he had gone to Carlsbad or Kissingen.

There is no doubt that we are enabled, by a prolonged and carefully regulated course of purgative waters, to exert a profound curative and alterative action upon the system.

In certain cases of chronic catarrh of the stomach, I have frequently found the greatest benefit to follow a rather unorthodox procedure. It is to let the mid-day meal consist *entirely* of fresh ripe fruit. Whilst fruit eaten with other articles of diet at a mixed meal will often disagree, yet taken in this manner, I have found it tolerated to a surprising extent, and with marked improvement in the general condition of the patient. It interposes, as it were, a barrier between the two fermentable farinaceous and albuminous meals, and enables the stomach to get rid of all unhealthy mucus and abnormal ferments. But no bread or anything at all except the fruit must be taken. The acidity of the fruit appears to act as a direct tonic to the stomach, and the acid salts

contained supply a systemic want, as dyspeptics of this class are rarely able to take sufficient vegetables.

Medicinal Treatment of Hyperchlorhydria.—There are two alternative methods of treating hyperchlorhydria with drugs: (1) The purely palliative method by means of alkalies, and (2) the attempt to restrain the secretion of acid by the administration of the dilute acids or other drugs acting upon the gastric mucous membrane. In practice we are prevented from acting as scientifically as we could wish, from the fact that patients, as a rule, are impatient and want immediate relief. If we do not give it to them, they leave us and obtain other advice. It is best, therefore, to combine the two methods of treatment—that is to say, to give a dose of dilute acid or other drug before the meal for its specific action on the stomach, and then after the meal, when the pain comes on, to give sufficient alkali to relieve it.

As regards the administration of alkalies, there is a point to be considered before we allow the theoretical considerations established by Linossier and Lemoine to influence our practice. In their experiments the alkali was introduced either into the empty stomach or into the full one in sufficient quantity to neutralize the acid therein. In all cases the reaction of the stomach was rendered alkaline. If we do this we know that we shall provoke a fresh secretion of gastric juice. But if we avoid completely neutralizing the stomach, and introduce just sufficient alkali to bring the acidity down to normal, no such effect will be produced. And as we have no reason to suppose that gastric juice of normal acidity produces any pain, we can give the relief that we wish, and that the patient demands, without the risk of making matters worse.

The results arrived at by Linossier and Lemoine demonstrate very clearly the dangers and fallacies of the treatment by very large doses of alkalies recom-

mended by some French and German specialists. The effect of completely neutralizing the stomach contents several times in succession after a meal is simply to tire out the secreting tissues of the stomach in vain endeavours to preserve the normal degree of acidity. When they are functionally exhausted and incapable of any further secretion, and not until then, the stomach contents remain alkaline. We are thus paying a heavy price for the relief obtained. The glandular structures must infallibly become hypertrophied, and thus capable of hypersecretion. The total amount of HCl secreted will be much in excess of what would have been produced if no medicine had been given at all. In a word, there can be no more effectual way of ensuring that the comparatively mild disease hyperchlorhydria shall progress, and eventually become permanent hypersecretion, than by giving an alkali in this manner.

We can fortunately secure all the benefits of alkaline treatment, and avoid the dangers, by not introducing enough into the stomach at one time to completely neutralize its contents. We can then do nothing but good, for as long as the stomach contents remain even faintly acid, there can obviously be no such stimulation of the secretory glands as Linossier and Lemoine have described.

We may, nevertheless, have to give in the aggregate a very large quantity, as we must not forget that there is much more acid than normal in the stomach. In order that we may not completely neutralize the stomach contents, we must give the alkali in medium doses repeated at short intervals until the pain ceases, when we may, I think, assume that the stomach contents have been rendered of the normal acidity. The medicine should then be intermitted until the pain returns, when it must again be taken in the same manner. As regards the choice of an alkali, the bicarbonate of sodium is usually

preferred as being the least toxic. The best dose to give is 10 grains every ten minutes until relieved. As much as $\bar{3}i.$ or $\bar{3}ii.$ may be necessary, and half an ounce or more may be given in the twenty-four hours with impunity. Remember that it is not the total quantity taken in the day that will do harm, but too large a dose given at one time. It is hardly ever necessary to give it after breakfast, especially if that meal has consisted mainly of albuminous substances. It is no use giving it until the time when, the food having absorbed all the free acid it can, an excess of this substance begins to appear in the stomach. The best way of ordering it is to direct the patient to take 10 grains every ten minutes until relieved, commencing with the first appearance of the pain, but not earlier than two hours after the meal. If necessary, the patient may take from four to eight such doses after lunch and dinner respectively.

Other alkalies besides bicarbonate of sodium have been advocated, but the advantages are more apparent than real. Dr. Burney Yeo, in his recent manual of clinical therapeutics, describing the treatment of a case of hypersecretion says: 'Some prepared chalk was added to the sodium bicarbonate, as the latter is too soluble, and its neutralizing action is therefore too soon exhausted. The insoluble lime salt acts more slowly, and is dissolved only in proportion to the acid secreted.' From what I have already written, the reader will at once see the fallacy of this argument. If the chalk be dissolved only in proportion to the acid secreted, it presupposes that the contents of the stomach have been rendered absolutely alkaline, or at least neutral (it would be impossible so to regulate the dose as to secure neutrality), and I hope that I have sufficiently demonstrated that this should never be allowed. In addition to the danger of over-stimulating the gastric glands, there is the well-known fact to be taken into consideration that micro-

organisms can grow in a stomach which is alkaline or neutral. We have thus another reason for keeping its reaction of normal acidity. The question of the relative solubilities of the soda and chalk has now to be considered. I venture to assert that the ready solubility of sodium carbonate is a point in its favour. Unless the drug that we give will dissolve at once, we cannot tell how much neutralization it has effected, or when another dose will be required.

Treatment by alkalis must, I repeat, simply be regarded as a means of relieving pain whilst waiting for the other measures which are being adopted to so modify the condition of the patient as to check the tendency to the increased formation of HCl.

Medicinal Treatment of Hypersecretion.—The indications for medicinal treatment are two :

1. To check, if possible, the excessive secretion.
2. To attempt to neutralize the injurious effects of the constant presence of acid in the stomach.

I would first of all impress upon my readers that a very lengthened and systematic course of treatment will be necessary to give the patient a chance of recovery. One must be particularly careful not to mistake the periods of intermission that occur in the first stage—whether spontaneously or from the effects of medication—for complete cures. If this is done, the patient, thinking that he has recovered, abandons his treatment under the impression that there is no further necessity for it, and the disease is allowed to make headway. As regards the first indication, several drugs have been given with more or less success, with the object of checking the abnormal secretion. We will only consider one or two of the most promising.

Nitrate of Silver.—This has been employed in pills or capsules, and also in the form of lavage, the stomach having been washed out with a 0.1 per cent. solution. I

have made an extensive trial of this method of treatment, and cannot point to a single case where it has been completely successful in arresting the secretion. Its usual action is to reduce the acidity of the gastric juice very often nearly a half, but it appears to have no effect in restraining the amount of fluid secreted.

Atropine.—This drug is worthy of a trial. Voinovich records a successful case. This had lasted two years, and had resisted all methods of treatment. Two milligrammes a day were given in divided doses. After three days there was a marked improvement, and examination of the stomach at the end of the tenth day showed that hypersecretion had ceased. I may say that, since the publication of this case, I have made a trial of this medicine in several cases, but without success.

In my own experience the most efficacious agents for the purpose of checking the continual flow of gastric juice are local sedatives to the stomach, such as morphia, chloral, cocaine, and picrotoxin, and general sedatives to the nervous system. For the latter purpose I have been in the habit of prescribing hydrobromic acid and cannabis indica in combination. I do not think that bromide of potassium should be given in these affections, for fear that the HCl might liberate free bromine, which would act as a dangerous irritant to the coats of the stomach.

The second indication is to try and minimize the injurious effects of the excess of hydrochloric acid on the coats of the stomach. This is met by the administration of alkalies, and by washing out the stomach. The method of using the former has been fully treated in our remarks on the management of cases of hyperchlorhydria, and we have nothing material to add to it here. In most cases large doses of alkalies will be required to relieve the intense pain. Lavage of the stomach in hypersecretion has been discussed in the section devoted

to it. It is important to note that the remedial agents usually given in ectasia of the stomach from other causes—strychnia and nux vomica—are inadmissible in hypersecretion. The reason is that they would tend to stimulate injuriously the mucous membrane, and this is an action which we must try and avoid as much as possible.

Medicinal Treatment of Ulcer.—We may divide our drugs into several groups :

1. Those which have a detergent or cleansing action on the part.
2. Medicines which promote the healing action.
3. Those that relieve pain.
4. Agents which raise the general tone of the system.

1. Medicines which cleanse the part or remove mucus from it.

The most useful are sodium sulphate and sodium bicarbonate, either separately or in combination. We have already alluded to the morning dose of sodium bicarbonate in the first stage of ulcer. The best way of giving them combined is in their natural form of Carlsbad water (=sulphate, carbonate, and chloride of sodium). The administration of this water is often of the greatest advantage, especially in old-standing cases. It stimulates peristaltic action, dissolves the stringy and tenacious mucus from the walls of the stomach, and facilitates its expulsion into the intestine.

It should be given at a temperature of 100° Fahr. every morning, before breakfast, in sufficient quantity to produce one or two actions of the bowels. It is conveniently divided into three or four doses, and taken at intervals of a few minutes.

2. Medicines that promote the healing process. These are the alkalies, nitrate of silver, and chloroform water. The alkalies indirectly assist the healing process by

neutralizing the acidity of the stomach. We know that excessive acidity is the cause of the development, persistence, and continued progress of the ulcerative process, and it is, therefore, obviously of the highest importance to reduce it as near normal as we can. The alkalies should be given in precisely the same manner as in hyperchlorhydria and hypersecretion.

Nitrate of silver is of considerable value in cases which do not readily yield to other modes of treatment. It probably acts by combining with the albuminous surface of the ulcer, and forming a thin skin over it, and thus protecting it from irritation and allowing it to heal. It may be given in doses of $\frac{1}{4}$ to $\frac{1}{2}$ a grain, made up into a pill with kaolin. In cases where it is probable that the ulcer is situated on the anterior upper portion of the stomach, 2 ounces of water containing 2 grains of nitrate of silver dissolved in it may be given, and the patient afterwards made to lie down and move himself into various positions so as to bring the solution into contact with every part of the interior of the stomach. In this case, after a few minutes, a dose of salt and water must be taken to neutralize the excess of nitrate. Its action will thus be a local one upon the diseased tissues.

I have found chloroform water of great service. We all know its action on ordinary wound granulations—how it reddens them and promotes the healing process. We have every reason to believe that it has an analogous action upon the surface of a gastric ulcer.

3. Drugs that relieve pain.

The alkalies and nitrate of silver both have this action. In addition, we shall often have to make use of opium, morphia, or belladonna in the course of treating a gastric ulcer. I do not use cocaine much in my own practice, as I believe that the transient relief from pain that it gives is followed by a reaction, and I have reason to think that it interferes with the healing process.

4. The medicines that act as tonics to the system are of very great importance. We know that a depraved condition of the blood is one of the factors which must necessarily be present before the abnormally acid gastric juice can act injuriously upon the coats of the stomach. It is, therefore, unreasonable to expect the ulcer to heal as long as the condition of the blood remains the same. In cases where the Hb is deficient, iron, therefore, should be given constantly in large doses from the end of the second period. Contrary to what we might expect, we shall often find the perchloride taken without producing any uneasiness. It probably also acts as a caustic to the surface of the ulcer, and thus may even help the healing process. For ordinary routine practice, however, I advise either Blaud's pill or an extemporaneous albuminate prepared by the patient at the time of taking, by placing 15 drops, or whatever dose you are giving, of the Liq. Ferri Perchloridi into a wineglassful of egg-water, this latter consisting merely of the whites of three eggs stirred up in a pint of cold water. Preparations such as dialized iron must be avoided, as they are probably inert. They are in such an unstable condition of equilibrium that the mingling with the dilute HCl in the stomach produces a precipitate of ferric oxide *insoluble* in any excess of HCl that it can meet with in the stomach. This is a fact not generally known, but anyone can verify it for himself.

Arsenic is another drug of great utility in ulcer of the stomach. It is most valuable in cases where the microscopical examination of the blood and the spectroscopic appearance of the urinary pigments point to the fact that the anæmia is due rather to excessive hæmolysis than to defective hæmogenesis.

Medicinal Treatment of Dilatation.—In addition to the use of lavage, electricity, massage, baths, and a special diet, which form the main portion of our plan of treat-

ment, we can do a great deal by the intelligent use of drugs. With them we help to secure the asepticity of the alimentary canal, and to increase the tonicity of the stomach walls.

For the former purpose we use the antiseptic substances enumerated on p. 245, and for the latter ergot and strychnine.

Medicinal Treatment of Cancer.—Whilst, unfortunately, a specific has not been discovered, we have yet two drugs which are especially useful in the treatment of cases of cancer of the stomach. These are condurango and hydrochloric acid. Condurango appears to have an undeniable action in relieving the special form of dyspepsia which accompanies malignant disease. Hydrochloric acid is indicated to combat the anachlorhydria which is present. It should be given in a solution of the same strength as that of the normal gastric juice when digestion is at its height. A considerable quantity of such solution may be taken in divided doses during the digestive period.

The use of lavage is discussed on p. 227.

During the course of cancer of the stomach special symptoms often arise from time to time which may require to be treated on general principles.

Medicinal Treatment of Gastric Neurasthenia.—If we wish to succeed in the treatment of functional dyspepsia depending upon neurasthenia, we must discard almost entirely the traditional method of prescribing. For example, we have a case of dyspepsia in a nervously-exhausted individual, with the leading symptoms as follows: Epigastric discomfort and sinking before meals, the food giving temporary relief. About an hour or two after the meal, pain or discomfort at the epigastrium, feeling of constriction in the throat, flatulent distension of the stomach, which is tympanitic, and which, by impeding the descent of the diaphragm, produces alarming

difficulty of breathing, accompanied by, perhaps, a sense of impending dissolution. This invariably happens, whatever kind of food is taken.

The old routine plan of treatment would be to restrict the diet of the patient, and to give a soda and bismuth mixture before meals, with perhaps a few drops of hydrocyanic acid.

But to effect a cure we must recognise that this stomach trouble is but a local manifestation of a constitutional state, and treat it accordingly.

The bismuth and soda mixture certainly gave relief, but it was only temporary. Let us administer, instead, a little of the valerianate of zinc three times a day, and pass the continuous galvanic current, daily, from the nape of the neck to the pit of the stomach, and we shall probably find that in a few days the patient can eat with impunity those very articles of diet which formerly disagreed with him.

That is to say that, when once we have established the fact that the stomach trouble is part of a neurasthenia, we must practically ignore it, and devote our attention to the general condition. *We must treat the general neurasthenia, and its local manifestation will take care of itself.* We may, however, give strychnine with advantage in some cases to combat atony of the stomach-walls, and hydrochloric acid in cases where anachlorhydria is a marked feature.

It is impossible in the narrow limits of a work of this description to give specific directions for the medicinal treatment of each of the many forms in which gastric neurasthenia presents itself. Arsenic, ergot, nitrate of silver, zinc, bromides, valerian, musk, cocaine, chloral, picrotoxin, actæa, iron, quinine, or several other drugs, each have their respective spheres of action, and will produce good results when given by one familiar with the indications which call for them.

Certain broad principles may, however, be enunciated which will help the practitioner in selecting the treatment appropriate to the case under observation.

The first thing to do in a case of gastric neurasthenia is to try and ascertain the cause. If we can remove this, we have already made great progress towards a cure. It is a fortunate thing that so many neurasthenias depend upon causes which can readily be removed. Tobacco, tea, alcohol, used in excess, will account for a large proportion of the total number of cases which come under treatment. Absorption of pus, or toxines, is more difficult to deal with. If there is pyorrhœa alveolaris, the teeth and gums must be put properly into order before we commence treatment. An erosion of the os uteri must be cured. If auto-intoxication from the alimentary canal is suspected, we must secure intestinal antisepsis. Having removed the cause as far as may be, we can proceed to the specific treatment of the patient with some hope of success.

The treatment of a case of gastric neurasthenia must be considered under two headings: the treatment of the general neurasthenic condition, and the treatment of the local gastric troubles. The first of these is by far the more important. If we can cure the general neurasthenia, the local troubles will rapidly disappear.

1. *Treatment of the General Neurasthenia.*—The following are the chief means at our disposal for this purpose:

(a) The continuous galvanic current applied in the method known as central galvanization. This is by far the most potent weapon which we have at our command (see p. 234).

(b) General faradization. This is useful alternated with the preceding as an auxiliary measure.

(c) Sponging with cold salt-water, and the cold spinal douche.

(d) Fresh air, moderate exercise.

All these, although not belonging strictly to this section, we enumerate now for the sake of completeness.

(e) Drugs.—In selecting the particular medicines, we must first of all attend to the functions of the body. We must procure adequate sleep. We must secure a daily action of the bowels. Then we should attempt to improve the metabolism of the body, and the amount of hæmoglobin in the blood if that is deficient. This we can do with iron or arsenic. Lastly, we must depress the irritability of the spinal cord with bromides if it is in excess, or raise it with strychnia if in defect.

2. *Treatment of the Local Stomach Troubles.*—For gastric hyperæsthesia we may use morphia, opium, belladonna, cocaine, picrotoxin, solanin, and hydrocyanic acid.

For gastric atony—strychnine, orexin, vegetable bitters, and alcohol.

A great many cases derive much benefit from the use before meals of the old-fashioned *mistura gentian*, alkaline, which contains sodium bicarb., ammon. carb., and gentian. The soda and ammonia act as antacids, and powerfully stimulate the secretion of gastric juice, whilst the gentian promotes appetite and increases the activity of the vital processes carried on by the structures contained in the mucous membrane of the alimentary canal. At my suggestion, Messrs. Burroughs and Wellcome have made tabloids containing the above combination of drugs. These are a great convenience when away from home, as they can be carried in the pocket and taken before meals without attracting observation.

CHAPTER VII.

ILLUSTRATIVE CASES FOR COMMENTARY AND DIAGNOSIS.

IT is well known that a little concrete teaching is of much more value than a great deal of theory. We may commit to memory a number of rules, but we can never become expert diagnosticians without practice in their application. It is also tolerably certain that in an ordinary mixed hospital practice the student will have to wait a considerable time before he will meet with typical examples of all the affections of the stomach which are attended by indigestion.

These considerations have led me to include in this book a short chapter containing illustrative cases representing some of the principal problems which are encountered in the diagnosis of diseases of the stomach. They are intended for the student to solve. Some are very easy, and some the reverse. Upon them he can practise the application of the principles which he has learnt in the preceding pages.

I would mention that, with the exception of one hypothetical case, which, however, involves points of great importance from an educational point of view, none of them are fictitious. With the exception of seven, which are taken from the 'International Clinics,' they have all actually come under my own observation.

In order that the student may utilize them to the full extent, I would suggest that he write a commentary upon each one, stating

1. The diagnosis as far as he is justified in making one with the data provided.
2. The points upon which he must be informed before his diagnosis can be considered absolute.
3. The answers to any special questions which may be appended to the case under consideration.

He should then finish by writing a full account of the Etiology, Pathology, Course, and Treatment of the disease which he believes the description to represent. All this is to be done without consulting the text.

All classification or order of arrangement has been purposely avoided in order that no clue may be afforded as to the nature of the cases, except the written descriptions.

CASE I.

J. B., a man of from fifty to sixty years of age, consulted me early in 1893. Until recently he had not suffered from any gastric symptom. Without any known cause he has begun to lose appetite, and to feel some uneasiness after food. He has no real pain, but a feeling of heaviness and fulness in the epigastrium, accompanied by a certain degree of nausea, and belching of wind. To these gastric troubles is added a marked tendency to constipation. Examination of the heart, lungs, and abdomen gives negative results.

Two hours after a test breakfast the stomach contents contained absolutely no free hydrochloric acid, but gave an intense reaction with Uffelmann's reagent.

The reactions with the stomach tests were as follows :

Salol	...	...	185 min.
Rhubarb	...	...	20 „
Günzberg	...	...	180 „

What is the disease almost certain to be in this case ?

What fact in the above report would, by itself, be almost sufficient to lead to a diagnosis ?

CASE II.

J. D., a medical man, æt. thirty-nine, came under my observation early in 1894.

Has never had any serious illness. As a boy at school he was troubled very much with constipation, and neglected himself, his bowels often not being opened for several days at a time.

He began to suffer with his digestion about the year 1882, after a prolonged period of worry and overwork. At that time he was very much troubled with flatulence. About this period he developed certain phobias and morbid ideas which have recurred with less intensity at intervals. At this time his attacks of flatulence caused so much dyspnoea that he had to abandon work for a time on several occasions. He states that under a course of galvanism and valerianate of zinc he lost a good many of his uneasy sensations, but has continued to be troubled with indigestion more or less ever since. Has been much worse since 1891, when he had influenza.

At the present time he complains chiefly of flatulence. This sometimes occurs before a meal, and is then relieved for a time by food. Usually, however, it comes on very shortly after a meal, and lasts for three or four hours. It is expelled with a loud explosive noise, but oftener it cannot be moved, and distends the stomach, producing great discomfort. In an attack of this kind nothing seems able to disperse the wind, the greatest relief being produced by a strong glass of spirits. There appears to be a spasmodic closure of the cardiac and pyloric orifices, which prevents the wind from escaping from the stomach. During such an attack the stomach is tympanitic on percussion. The distension of the

stomach produces a sense of suffocation and a very peculiar 'clutching' feeling in the throat, possibly due to irritation of the pneumogastric nerves. The patient often experiences an attack like this on going to bed, and is unable to get to sleep until about three o'clock in the morning, when the stomach seems to empty itself and the attack subsides. .

Appetite is very good. Actual pain is absent, but there is often a sense of fulness after a meal. Memory is much impaired, and the patient feels that he is losing his power of concentration. He often has localized sensations of numbness or tingling, or cold in the fingers and feet, and is easily tired. He certainly takes more alcohol than he should, but never gets the slightest degree intoxicated. He also smokes in what is excess to him, as he cannot stand what to other men would be a moderate amount of tobacco. He also takes far too little active exercise. He even now will have occasionally a sudden fear come over him, or a persistent idea recurring in his mind which he cannot banish by an effort of the will. Sometimes his heart palpitates, or 'flutters,' or intermits, and he often feels as if his breathing were going to stop. In fact, at these times he has the feeling that the act of respiration is only kept going by a voluntary effort, and that if he were to cease thinking about it the function would cease. He often has a dull feeling at the top or the back of the head, and sometimes when his head feels clearer than usual, and he is congratulating himself upon his pleasurable sensations of health, a sudden cloud seems to roll over him, coming from the back of the head, and he feels stupid and drowsy.

He is well nourished, and inclined to become rather stout. He looks the picture of health, but has a slight twitching of the muscles of the face. The heart and lungs are normal. Splashing can be obtained as low

as one inch above the umbilicus, two hours after a meal.

After a test-meal the reaction times are as follows :

Salol	...	...	150 min.
Rhubarb	...	...	15 „
Günzberg	...	...	90 „

What is the diagnosis ?

What would you expect an examination of the stomach contents to show if taken at the following times ? :—

1. Before breakfast.
2. Two hours after breakfast.
3. Seven hours after dinner.

What is the prognosis ?

CASE III.

Miss A., æt. nineteen, a hard-working teacher in a Board-school, came under observation in January, 1891.

She had always enjoyed pretty fair health until the last six months, when she began to suffer from indigestion.

She has epigastric pain, but not very severe, coming on shortly after food, and often terminating in a couple of hours or so with vomiting. She has never brought up any blood. She is very thirsty, especially directly after food, and during the night. She often empties her water-bottle in her bedroom before the morning. Her appetite is very good as a rule ; in fact, she feels almost always a great craving for her food before the meal-time arrives. Her bowels are alternately constipated and relaxed, and she often has diarrhoea at night. Her catamenia are scanty, and accompanied by much pain. She also suffers from palpitation of the heart and shortness of breath on moderate exertion.

Her tongue is moist and lightly furred. She is obviously anæmic, and on making an examination of the blood it is seen that the number of red corpuscles has

sunk to three thousand five hundred per cubic millimetre. The hæmoglobin is 45 per cent. On palpating the abdomen an epigastric painful pressure spot is found to be present. The splashing sound can be obtained one inch below the umbilicus. An opportunity having arisen of obtaining some of the vomited material, this was found to contain 3·5 parts per 1,000 of free HCl.

Are you justified in this case in making a diagnosis of ulcer ?

If so, what are the facts which are diagnostic ?

What is the clinical significance of the alternation of constipation and nocturnal diarrhœa ?

CASE IV.

Mr. C., thirty-five years of age, presents a good general physical development, and an outward appearance of being well nourished. He has been occupied chiefly in office work for the last ten years, has taken but little outdoor exercise except walking to and from his office ; takes one or two cups of coffee with his breakfast, a cup of tea at supper, and sometimes a glass of beer at lunch. Generally smokes a cigar after meals, with one or two extra in the evening.

Five years ago he began to notice an unusual heavy feeling in his stomach an hour or so after his meals, with occasional eructation of gases, but this would usually disappear before the next meal. About the same time his bowels began to be less regular, with a little coating on the tongue, and dull feelings in the head, which would be relieved by a laxative and a few meals of lighter diet. From these slight beginnings the symptoms have gradually increased, until, during the last year, everything he has eaten has commenced soon after to feel like a pound of lead in his stomach, and in an hour or two to generate very large quantities of gases, while the bowels have not moved once a week

unless aided by artificial means. Occasionally, in the latter part of the day, instead of generating gases, the food becomes acid and causes burning pain, such as is generally called 'heartburn,' with restlessness and despondency. Like most patients similarly affected, he has taken a variety of laxative mineral waters, and a great variety of other physics, especially such as are reputed to act upon the liver, but with only the most temporary relief. Heart and lungs are normal. (Davis, 'International Clinics,' 1891, vol. ii., p. 66.)

What additional information do you require before you can commit yourself to a diagnosis ?

What is the pathology of this condition ?

CASE V.

Mr. Q., a young man, æt. twenty-six, came under observation on March 10, 1894. He had a strong family history of tubercle, his brother at the time being the subject of advanced phthisis, and his father having died of it.

For many years he has suffered with great pain coming on about two hours after meals, and terminating after a variable interval with vomiting. For the last year he has been growing very much thinner.

At the time when he came under observation he was living almost entirely on milk, being unable to keep anything else on his stomach. He always had great pain after every meal, and vomited to the extent of several pints at a time, about three times a week.

He was a tall, emaciated man, and looked extremely ill. On an examination of his abdomen, splashing could be obtained almost down to the pubes. An examination of the vomited material disclosed the fact that it contained an excessive amount of free hydrochloric acid. Lactic acid was absent. There were also present Jaworski's corpuscles and free epithelial nuclei.

With great difficulty he was taught to pass a tube and wash out his stomach, and employed this procedure regularly, to his great relief, until June, during that time increasing in weight.

Unfortunately, on June 2, he was taken suddenly with convulsions, and had a fit every six hours until June 5, when he became unconscious. On June 14 he became slightly more conscious, and at that time his pulse was 108, full and regular. From this time he had no more fits, but gradually sank, and died in a few days from exhaustion.

The fits somewhat resembled those of epilepsy, and consisted of general spasms, at first tonic, and afterwards clonic, but were not attended by loss of consciousness, and were followed, as we have seen, by coma.

What relation did the fits bear to

1. The disease of the stomach?
2. The use of the stomach-tube?

CASE VI.

This is a hypothetical case for practice, involving principles of very great importance.

The patient is an adult who has enjoyed good health, with the exception of slight dyspepsia, which commenced to trouble him several years ago.

The appetite is good. Two or three hours after food a sense of heaviness or heat at the pit of the stomach is experienced. The stomach becomes blown out, there are eructations of wind, and often regurgitation of fluid having an acid odour and taste. The fæces are soft, and are expelled slowly.

Up to this point, between what affections may the diagnosis lie?

What would be the effect upon your diagnosis of finding one or more of the following conditions associated with the symptoms already given?

1. Acid and stinking fæces, expelled with pain.
2. The above, with the addition of diarrhœa.
3. The same, with the addition of a swollen liver, and aching in the right hypochondrium.
4. Jaundice, which goes off after a few days.
5. Pityriasis versicolor.
6. Urticaria.
7. Phlebitis.
8. Pigment spots on the fore-arms.
9. Nodosities of the finger-joints.

In each case, what further physical signs do we require to render our diagnosis absolute ?

What does the acid odour of the liquid regurgitated tell us ?

CASE VII.

Mrs. B., a shopkeeping woman, aged twenty-six years, and presenting an anxious and rather dejected expression of countenance, says she is extremely nervous and despondent, excited and worried by mere trifling causes, sleeps restlessly, and in the first part of the night often starts from sleep with palpitation, oppression across the chest, and eructation of gases from the stomach. Her appetite is variable, and everything she eats causes a sense of fulness and epigastric distress extending to the left side, followed by gaseous distension and eructations, or soreness and burning in the epigastrium. Her bowels move only once in two or three days, unless they are prompted by laxatives. There is a light coat on the back part of the tongue. Her menstrual periods are regular, natural ; renal secretion free, but often deposits ammoniacal salts on cooling. Her pulse, respirations, and temperature are usually natural, and physical examination reveals no sign of either cardiac or pulmonary disease. Her tissues are fairly well nourished. She is in the habit of going to her shop at 7.30 a.m., and attending to her work until 9.30 p.m., with only brief intervals for meals, and con-

sequently takes very little out-door exercise or rest. She has been following this routine for several years. (Davis, 'International Clinics,' 1891, vol. ii., p. 66.)

In a case like this, what reaction-time do you expect to find with the iodide, rhubarb, salol, and Günzberg tests respectively?

CASE VIII.

Mrs. B., aged forty years, housekeeper, of fair physical development and nervo-sanguine temperament. She is much confined within doors, occupied with domestic affairs, and accustomed to the free use of tea and coffee. Her countenance is rather pale, but not expressive of anxiety, and she has lost some flesh. She complains chiefly of pain in the epigastrium, extending laterally under both breasts, and often up into the chest, particularly to the left, which causes her to think that she has 'heart disease.' These pains become most troublesome from one to two hours after eating, and are then accompanied by a sense of fulness and copious eructation of gases, oppressed breathing, and sometimes palpitation, especially in the evening and first part of the night. Her pulse, temperature, and respiration are normal, and physical examination reveals no signs of either cardiac or pulmonary disease. She says her appetite is good, bowels regularly moved every morning, and she feels much better when taking moderate exercise in the open air. (Davis, 'International Clinics,' 1891, vol. ii., p. 66.)

In this case, what would you expect an examination of the stomach contents to show, taken respectively? :—

1. Before breakfast, the stomach having been washed out the night before.
2. Before breakfast, the stomach *not* having been washed out the night before.
3. Two hours after a test breakfast.
4. Seven hours after a test breakfast.

CASE IX.

The patient, a middle-aged man, consulted me in January, 1894. He gave the following history :

As a young man, he indulged in excesses of every kind, and as he was well off, always lived well and drank a good deal. In addition to this, he was habitually overworked, and had considerable mental worry. At about thirty years of age he began to suffer from a sense of uneasiness after food, and this gradually increased in intensity as time went on, until it became real sharp pain. This stage was reached about the time when he attained the age of thirty-five years. As far as he can remember, the pain at that period used to come on about two hours after a meal, and lasted for two or three hours. He often had the pain only in the afternoon after his mid-day meal, and at other times was free. At this stage of his complaint he used to have periods, varying from two or three days to several weeks, during which he was free from all discomfort, and in which he could digest his food quite well. As his disease progressed, these periods of intermission became shorter, until they ceased altogether. After a time the attacks of pain began to terminate by the regurgitation of a little acid liquid, and later on by vomiting. At about the age of forty he began to have the pain after every meal, and at night. For the next few years he was extremely ill, and consulted many medical men without any permanent benefit.

He now, at the age of fifty, presents the following symptoms :

He is unable to take any food except peptonized milk, gruel, and soup. He is tolerably comfortable as long as he confines himself to this diet, but anything else gives him great pain, and inevitably produces vomiting. He suffers a great deal from flatulence, and his abdomen is

tympanitic. He is very emaciated, and extremely weak. For the last month he has been confined to his couch. On deep palpation, a slight thickening can be perceived in the epigastric region.

On making an examination of the stomach with a tube before his first meal, a small quantity of clear fluid can be extracted, free from mucus, and containing no free HCl.

A similar examination made three hours after the ordinary test meal shows that the stomach contents contain the merest trace of pepsin and of HCl, and that absolutely no digestion has taken place in the food.

As regards the subsequent course of the case, the unfortunate patient slowly sank, and died of inanition in June.

This is an absolutely typical case, and the student should be able to make an instant diagnosis with the data before him.

There are three important points, however, to which attention should be directed :

1. What single fact in the history of the case would negative the idea of cancer ?
2. What is the diagnostic significance of the absence of mucus in the stomach contents ?
3. What is the significance of the thickening felt on deep palpation in the epigastric region ?

CASE X.

Mrs. H., a married woman, æt. thirty, came under my observation in 1891.

No history was obtainable beyond the fact that she had suffered with her heart and her stomach for many years.

Her present symptoms were as follows :

Loss of appetite, partial loss of taste, flatulence, and eructations of gas after meals, constipation alternating

with diarrhœa, and occasional morning vomiting. She frequently comes over giddy in the street. Her dyspeptic symptoms come on an hour or so after food, and last for about three hours.

Her chief trouble, however, is shortness of breath, which, coming on an hour or thereabouts after meals, may last from a few minutes to a couple of hours. It is always considerable, but sometimes so intense as to amount to true orthopnœa. During the attack she has often palpitation of the heart, and a sense of constriction in the chest, with severe pain passing through to the left shoulder, and running down the left arm.

Auscultation of the heart during an attack reveals the fact that there is marked accentuation of the pulmonary second sound, and a slight systolic bruit at the lower part of the sternum. There are no pulsations in the veins of the neck. After the attack is over the cardiac signs disappear.

The time-reactions of the stomach tests are as follows :

Rhubarb test	...	...	30 min.
Salol	...	...	200 „
Günzberg	...	...	190 „

Examination of the stomach contents gave the following results :

(a) *In the morning before breakfast, the stomach having been washed out the preceding night—*

A considerable quantity of fluid was withdrawn, neutral in reaction, and slightly tinged with bile. It filtered very slowly, and acetic acid added to the filtrate gave a copious precipitate.

In the sediment remaining on the filter-paper were found cell nuclei, gastric epithelial cells, leucocytes, sarcinæ, and yeast ; some cellulose spirals from vegetable matter, undigested starch granules, and muscular fibres.

NOTE.—This examination was made on several subsequent occasions with practically the same results.

(b) *Two hours after a test meal containing meat, the stomach having been previously washed out.*

Acidity, 3 per mil. Free HCl present only in slight traces. A very intense reaction with Uffelmann's reagent. Reaction of erythrodextrin absent. Reaction of achroodextrin present.

(c) *Seven hours after a similar test meal—*

Four ounces of fluid were withdrawn, giving the reactions of peptone and achroodextrin, and containing undigested starch and meat fibres.

What name has been applied to the form of dyspnœa present in this case?

What is the condition of the heart, and what relation does it bear to the dyspnœa and stomach troubles respectively?

Why, in the examination (a), did the liquid obtained from the stomach filter slowly? What indications as to the stage of the malady was afforded by the precipitate produced by acetic acid? What do you conclude from the presence of alimentary residues at this examination? Why was this examination made several times?

CASE XI.

The patient is a physician, forty-four years of age, and since the age of twenty-one he has practised his profession. His father died at seventy of what is believed to have been gastric ulcer. The patient's mother is living at the age of seventy. He has one brother who suffers from indigestion, and four sisters, one of whom has some heart difficulty, and two have slight dyspepsia. When a student at college, the patient suffered intensely from indigestion. He subsequently practised medicine, and although he has been active and able to work, he has been rather delicate, and suffered with painful dyspepsia all the time. About four years ago he had a very severe hæmatemesis while suffering from pain and distress in

his stomach, and vomiting. Subsequent to the hæmatemesis, he vomited mucus, and had great pain in the epigastrium and right shoulder. After this severe attack he became better than he had been for some years; but from time to time his trouble has recurred, with slight vomiting of blood and mucus, and with pain, inability to eat, loss of sleep, and it became necessary for him to take anodynes. When he came under observation, he was suffering intensely from pain in the epigastrium and right shoulder, and he was vomiting persistently. The vomited matter contained large quantities of mucus. Three or four months previously he had vomited a little blood. He was digesting little, and was very excited from his long-continued pain, and his nervous system was not improved by the use of morphia, of which he was taking one quarter of a grain hypodermically every six hours. Iced cream was the only nourishment that he could retain, and often his stomach would not tolerate even that.

An examination was made some hours after food, and it was found that on light percussion the lower border of the stomach was found to reach one and a half inches below the umbilicus. The splashing sound also could be elicited to this point. At a point half-way between the ensiform cartilage and the umbilicus, and two inches to the right of the median line, there was considerable tenderness, and slight induration on deep palpation. (Stockton, 'International Clinics,' 1893, vol. iv., p. 55.)

Between what diseases would the diagnosis lie before any physical examination had been made?

What gastric condition was present in the early stages?

What would be the treatment for a case like this?

CASE XII.

A. Y., æt. forty-eight, a single man, came under my notice in February, 1893. His history was as follows :

As far back as he can remember he has suffered more or less with his digestion, and from constipation. He has never had any serious illness until the influenza in 1891.

His present illness really dates from the attack of influenza, since which he has rapidly lost weight. During the whole of 1892 he has been gradually losing strength, and becoming thinner and paler. He has lost in all nearly two stone. His symptoms consisted, and still consist, mainly of flatulence and constipation.

He was examined on February 13, 1893. He was considerably emaciated, and his skin had a yellowish appearance, and was dry and rough.

Heart and lungs were normal, and nothing in the shape of a tumour or thickening could be made out in the abdomen. Splashing could be produced two inches below the umbilicus seven hours after a meal.

On examining the stomach contents, food residues were found in the stomach seven hours after a test breakfast. The gastric juice two hours after the meal contained .1 per cent. of free HCl, and was entirely destitute of digestive powers, as estimated upon white of egg in test-tubes after the manner given on p. 128. Only traces of lactic acid were present.

What fact negatives the idea of cancer in this case ?

CASES XIII.

The three following cases must be studied in conjunction :

A.—A married woman, never pregnant, thirty-five years old, of a nervo-lymphatic temperament, who has suffered much from little things, and has a life of worry

where others might have found content, who is in every way easily fatigued, but who suffers most from nerve-tire, presents herself for relief from indigestion. She says that all foods distress her; she has sour stomach, eructations of gas, and suffers from a sense of weight in the epigastrium. She does not vomit, but the distress referred to occasionally amounts to real pain. She has been long upon a restricted diet, and has become considerably anæmic, showing 40 per cent. deficiency in hæmoglobin. Her bowels are somewhat constipated, her urine is highly acid, loaded with urates, with occasional showers of uric acid and calcium oxalate crystals. Her skin is sallow, she suffers from headache, is easily disturbed by noise or light, is very susceptible to pain, and has been unable to work for two years. It has been said that she suffered from cerebral and spinal neurasthenia. Examination of the stomach contents shows, four hours after a mixed meal, a great excess of hydrochloric acid by Günzberg's test, the albuminoids in the form of peptones still present, the starches and fats but little changed. A meal of albuminoids alone disappears from the stomach within two hours from its ingestion, but the hydrochloric acid remains in excess; the stomach is irritable to the touch of the tube, the sense of weight and distress is worse when the stomach is empty, is temporarily relieved by food, and is almost entirely removed by very frequent meals of nitrogenous foods only.

B.—A manufacturer, having a large business and many worries, forty-five years old, has a good family history, and a personal history of having served in the American Civil War, since which time he has suffered from no severe illness, but has been all the while deeply engrossed in business. Always a spare man, about five years ago he began to lose flesh, and suffered from eructations of gas, and occasional attacks of gastralgia

of great severity. For these he usually had morphia subcutaneously, and after a day or two in bed resumed work as before, but was always conscious of something wrong with his stomach. These attacks have continued up to the present time. He also suffers from occasional attacks of sciatica, which usually follow the gastralgia. He has been dieted in a variety of ways, has been treated for dyspepsia by ordinary remedies, but without relief. He is now greatly reduced in flesh, is anæmic, easily fatigued, sleeps badly, and has persistent constipation. His urine is acid, and contains many crystals of calcium oxalate.

Upon palpation a loud splashing sound is developed over almost the entire abdomen, and by means of conjoined auscultation and percussion, it seems evident that the lower border of the stomach reaches the bottom of the abdominal cavity. This view is substantiated by inflating the stomach with gas, and is demonstrated by the passage of the stomach-tube. In this patient, to make siphonage possible, it was necessary to introduce it twenty-eight inches. Three pounds of semi-fluid matter was withdrawn from the stomach when it was supposed to be empty. The undiluted gastric contents showed that albuminoids were digested within a reasonable time, but not so quickly as in case A. Starches and fats were changed somewhat by fermentation, but had not undergone proper digestion. The mass contained a great excess of hydrochloric acid, also lactic acid as determined by Uffelmann's test, and fatty acids as determined by odour.

The patient was given daily lavage, preferably at night several hours after the last meal, and the application of the faradic current by means of the gastric electrode, in sufficient strength to produce contraction of the abdominal walls. The diet was limited to albuminoids at first, and the hyperacidity subdued by antacids. Under this treat-

ment he improved: his pain left him, he increased in strength, and his urine became normal.

C.—A girl, eighteen years of age, having a good family history. She was always delicate; had scarlatina at twelve, and intermittent fever at thirteen years of age. She menstruated first at twelve, and has been regular until recently. She has for several years suffered from lassitude, headache, and backache, and has been unable to attend school. She sleeps poorly, is irritable and complaining. Her motions are sluggish, her skin muddy, her eyes dull; her face expresses despondency. Her tongue has a thin yellow coat, and prominent papillæ. She suffers from loss of appetite, heartburn, eructations of gas and food, and a feeling of depression and weight after eating. Her urine is very acid, loaded with urates and crystals of calcium oxalate. Examination of the stomach contents shows that the starches are badly digested always. At times the hydrochloric acid is in excess, at other times it is absent. (Stockton, 'International Clinics,' 1893, vol. iii., p. 27.)

Each of these three cases, A, B, and C, represents a distinct type of the same affection. What are the distinguishing features?

The remaining cases are from the out-patient room, and are in the imperfect condition in which they were taken by the clinical clerk. They have designedly been allowed to remain so, and nothing which further examination or interrogation revealed has been added, for the following reasons:

1. Because in the hurry of actual practice the young practitioner will often be called upon to make a probable or working diagnosis from just such imperfect data.

2. Because they will in this condition afford more valuable training, as the student will have an opportunity of deciding what further facts he requires to be in a position to express a decided opinion as to their nature.

To make the best use of these cases, the student should take them one at a time, and, having read it over, ask himself the following questions :

1. Can I make a diagnosis with the facts before me?
2. If not, then,
 - (a) What further questions must I ask the patient?
 - (b) What methods of physical examination must I employ?

In each case enumerate all the different answers you might possibly obtain, or facts which you might observe, and study the effect upon your diagnosis.

3. If you think that the diagnosis is sufficiently obvious from the history supplied, ask yourself what further fact or facts would, if present, render your diagnosis absolute.

4. How would your diagnosis be influenced by finding in each case respectively :

- (a) The stomach normal in dimensions.
- (b) The splashing sound obtainable below the umbilicus.
- (c) Increase of hydrochloric acid in the stomach contents.
- (d) Diminution or absence of hydrochloric acid in the stomach contents.
- (e) Marked reaction with Uffelmann's reagent.
- (f) Alimentary débris in the stomach seven hours after a meal.
- (g) Fluid containing hydrochloric acid in the stomach before breakfast.
- (h) Normal gastric juice.

Having made a diagnosis, discuss the prognosis, and the treatment which you would adopt.

CASE XIV.

R. B., a French polisher, married man, aged twenty-seven. Came under observation on May 23, 1894. With the exception of a similar attack two years ago, has enjoyed good health up to the date of his present indisposition. About three weeks ago was attacked with pain about half an hour after dinner. This came on in paroxysms, lasting only a minute or so, and was very sharp, like 'a knife penetrating.' He now has this pain both after dinner and after tea. It comes on half an hour after the meal, and the paroxysms continue for about two hours, when they cease. He has palpitation of the heart when lying down in bed at night, and also if he lies down in the daytime. He feels faint on rising in the morning, and usually has several attacks of faintness during the day. He drinks tea three times a day, and smokes a good deal. His bowels are constipated, and he suffers from flatulence at night, but not after meals or at other times.

CASE XV.

A. B., single, æt. nineteen, tailoress. Came under observation on November 21, 1894. Was quite well up to six months ago, since which time she has been gradually getting into her present condition.

Her catamenia are absent, she never yet having had a period. She complains of shortness of breath on exertion, palpitation of the heart, frontal headache, and pain in the back. She has flatulence sometimes before, and sometimes directly after, meals, but no other dyspeptic symptoms.

She is markedly anæmic, and on examination the splashing sound can be obtained two inches below the umbilicus.

What is the probable explanation of the splashing sound?

CASE XVI.

E. R., married woman, æt. twenty-nine. Came under observation December 18, 1893. Has three children, the youngest six years old. Has never had any miscarriages. Has never had any serious illness, and has enjoyed good health until three months ago, when she began to be troubled with her stomach, and 'had to make herself sick before she could obtain relief.'

She complains of a burning sensation in the cardiac region, which comes on two hours after dinner, and sometimes at night. She does not vomit, nor regurgitate anything into the mouth. The pain lasts a variable time. She suffers considerably from flatulence, which comes on both after and before meals, and frequently before breakfast. She has headache at the vertex, radiating to both temples, and palpitation and shortness of breath, apparently independent of meals or exertion. Her bowels are constipated. The menses are regular. Her tongue is flabby, clean, and glazed, but nothing abnormal can be made out in the thorax or abdomen. She is very anæmic.

CASE XVII.

W. H., single man, æt. forty-one, joiner. First seen on July 18, 1894. Has been a heavy drinker. Never had any serious illness until twelve months ago, when he began to be troubled with his present symptoms.

Vomits every morning before breakfast. Complains of pain in his left side, worse in the morning after retching. In addition to this he has a tugging pain under the right lower costal cartilages, which comes on at different times during the day. He also has twitchings in different parts of the body. Occasionally headache. Appetite very bad. Bowels regular. Liver dulness normal.

CASE XVIII.

L. K., single woman, æt. twenty-nine, tailoress. Became an out-patient on July 30, 1894. Had typhoid fever at five years of age, and scarlet fever in childhood. Had rheumatic fever in 1881 and 1889. Was in bed eight weeks at the first attack. Had influenza in the December of 1893.

Her present illness began in January of this year, and she has been gradually getting worse.

She complains of pain over the sternum, brought on by walking, and coming on one or two hours after tea. There is also almost constant pain in the stomach; much worse in the evening, when it often terminates with the regurgitation of about half a teacup of clear, tasteless liquid. She very rarely has any considerable pain in the afternoon. There is only a trifling degree of flatulence. No palpitation and no dyspnoea. The bowels are regular. Catamenia scanty and irregular.

The cardiac impulse is in the mammary line. The first sound at the apex is not clear, and the heart is occasionally irregular. There are no cardiac bruits. The boundaries of the stomach, as estimated by percussion, are normal, and the splashing sound cannot be obtained.

CASE XIX.

M. P., a married woman, æt. twenty-seven. Came under observation on November 20, 1893.

Family history good. Has two living children, and had a miscarriage three years ago. Has never been strong, and has suffered with her stomach for years past. Has several times coughed up pieces of a substance like chalk. All her troubles have been much worse during the last month, at the commencement of which she contracted a cold on her chest.

She complains of pain in the left mammary region, coming on sometimes immediately after food, and sometimes independently of it. She has also an almost constant pricking feeling in the left arm, radiating up into the neck, and passing down into the fingers. There is palpitation and shortness of breath on slight exertion. There is a great deal of flatulence, and occasionally a sense of sinking at the pit of the stomach after food, accompanied by a 'fulness' in the throat. The appetite is very poor, and the food 'repeats.' Bowels regular. Catamenia regular, but scanty. Leucorrhœa between the periods. She is very nervous.

The tongue is red, slightly furred, with prominent papillæ. Pulse 72; small and weak. Heart and lungs normal.

CASE XX.

K. O., married woman, æt. thirty-six. First seen on January 15, 1894.

Has never been well since she had a fright at the age of eighteen.

She complains of a sensation of sinking in the pit of the stomach, coming on a short time after food, and of considerable flatulence, which occurs almost immediately after she has eaten anything. She says she feels 'that all her food is fermenting inside her.' Her bowels are regular; she has no 'whites,' and her periods last seven days. She always feels excessively ill on waking in the morning, and never feels good for anything until she has had her mid-day meal. She suffers from thirst in the morning. Her memory is very bad, and she is low-spirited. Her gums are tender. She has frequently pains behind the eyeballs, sleeps badly, but has no noises in the head. She has a marked degree of claustrophobia.

She is afraid of going to church for fear that she

might be taken ill there, and not be able to get out. For the same reason she will not travel by rail. When confined in a small room, or when shut in any place from which there is not free egress, she is taken with a feeling of panic, and bursts out into a sweat. She has constant flushes of heat over the body, and sometimes localized sensations of coldness.

CASE XXI.

E. G., a single woman, æt. twenty-seven, a laundress. First attended the hospital as an out-patient on June 25, 1894.

Has enjoyed good health up to twelve months ago, when she began to vomit.

She now complains of vomiting coming on after every meal. It occurs sometimes five or ten minutes after the meal, and never later than half an hour. She usually vomits in the morning before breakfast. Some little while ago the vomit was streaked with blood, but not latterly. She also complains of a circumscribed pain at the bottom of the breast-bone, which has on occasions been continuous for a week at a time. It does not appear to be affected by meals. When she lies on her left side in bed, the pain shifts to that side. There is no shortness of breath, palpitation of the heart, or swelling of the feet. The bowels are very irregular. Catamenia regular.

With the exception of a considerable amount of emaciation, nothing abnormal is revealed by a physical examination.

CASE XXII.

L. R., a married woman, æt. forty-two. Admitted an out-patient on September 10, 1894.

Her malady dates from an attack of influenza four years ago. Shortly after this she began to suffer with pain after food.

She now complains of pain in the pit of the stomach of such intensity as almost to bend her double. This comes on two or three hours after dinner and tea, and occasionally during the night. The attack is usually terminated by the regurgitation of a highly acid liquid. She never has vomited.

On examination there is found to be no emaciation, no enlargement of the stomach, and the heart and lungs are normal.

CASE XXIII.

E. S., an unmarried woman, æt. twenty-five. First seen October 13, 1893.

Has had quinsy several times when a girl. Had chorea at twenty. Her present illness began three years ago, and she says that last summer she was treated for 'anæmia.'

Since last week she has been sick after every meal. She complains of pain at the pit of the stomach coming on directly after food. This generally lasts for an hour or so, and then she vomits. On several occasions during the last few days she has vomited directly after food. When this was the case, the pain did not come on at the usual time. She has palpitation and shortness of breath on exertion, but her feet do not swell. She is very constipated, and her menses are irregular.

On examination, she is seen to be very anæmic. There is a soft systolic bruit over the pulmonary area, and the heart is apparently a little enlarged. Splashing sounds can be obtained as low as the umbilicus four hours after a meal. The lungs are normal.

CASE XXIV.

F. N., a girl, æt. seventeen. Admitted an out-patient on June 12, 1893.

Enjoyed good health until a year ago, when she began to lose colour.

She complains of giddiness, palpitation, and shortness of breath on exertion. Her bowels are constipated. Menses are regular. She is sick every morning before breakfast, and has pain at the pit of the stomach soon after each meal. A short time after food she begins to swell, and has to loosen her corset.

On examination, she is obviously extremely anæmic. Heart, lungs, and stomach are apparently normal.

In this case,

What is the cause of the 'swelling after food'?

Why does she vomit in the morning?

CASE XXV.

E. J., a married woman, æt. thirty. Admitted as out-patient on November 5, 1894.

She tells us that she has suffered on and off with the present train of symptoms for the last five years. Two years ago she had an attack of enteritis.

She complains of almost constant headache. She has a pain in the left mammary region, between the shoulders and across the loins, almost always present to a certain extent, but much worse after food. Has great flatulence whenever she lies down, and usually has 'waterbrash' half an hour after dinner and supper. Appetite is poor, and bowels confined. Her heart 'flutters,' particularly at night; and she suffers from 'flushes of heat all over her.' She is very nervous, and easily excited. Her catamenia have ceased for the last two years.

On examination, nothing abnormal can be made out in the abdomen or thorax by the ordinary methods of auscultation, palpation, or percussion.

CASE XXVI.

E. L., a married woman, æt. thirty-six. First seen on August 13, 1894.

Her father died of consumption, and her mother is now in bed ill with heart disease.

She had rheumatic fever six years ago after a confinement. Twelve years ago she says that she had an illness, also after a confinement, which, from her description, was probably puerperal septicæmia.

Her present illness began two or three months ago with pains in her limbs, attended with fever. She was in bed for a week, and then recovered to a certain extent; but the pains have never entirely left her. She had an attack of diarrhœa recently, which lasted two days.

She now complains of pains from the knees to the ankles whenever she gets a little tired from standing. Directly after food she has an attack of flatulence, which is very severe, and makes it so difficult to breathe that she feels as if 'every breath would be her last.' She appears to be unable to expel the wind either up or down. After such an attack has persisted for a little time, she often becomes faint, and 'comes over in a cold perspiration.' She has a feeling of pressure and fulness in the pit of the stomach after food, and is troubled with constipation. She is very nervous, and has palpitation on a slight emotion. Nothing abnormal can be detected in the thorax or abdomen by any of the ordinary methods of examination.

CASE XXVII.

J. G., a single woman, æt. twenty-four, a domestic servant.

Her father died of heart disease, and she has two sisters suffering from anæmia.

She was quite well until three years ago, when she went to service. She is worked very hard, gets very little exercise in the open air, and she sleeps in a badly-ventilated basement. She has had flatulence for the last two years.

She complains of palpitation of the heart and shortness of breath on exertion. The peculiarity of the

palpitation is that it always comes on directly after food, and very often while she is eating. It is often so severe that she has to leave the meal-table, and go and lie down. Her appetite is good. Bowels and catamenia are regular. One hour after food she experiences a sharp severe pain in the pit of the stomach, which seems to go right through to her back. This lasts generally two or three hours.

She is very anæmic, and there is a soft systolic bruit over the mitral area. As she is standing, lying, or sitting, there are constant gurgling noises, apparently proceeding from her abdomen, audible at a distance of two or three feet, and apparently synchronous with the act of respiration. These noises come on a short time after food, and last for three or four hours.

In this case,

What are the noises caused by ?

What would you expect to find on a physical examination of the abdomen ?

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ERRATA.

Page 36, line 2, insert decimal point after 7.
,, 65, line 5 from bottom of page, *for* 'Cause' *read* 'Course.'
,, 119, line 20, *for* 'Boaz's' *read* 'Boas's.'
,, 137, line 6, insert 'Cancer' after 'Dilatation' in synopsis.
,, 174, line 18, *for* 'dypepsia' *read* 'dyspepsia.'



